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COLLEGE OF NATURAL RESOURCES AND
INSTITUTE OF INTERNATIONAL STUDIES

COLLABORATIVE RESEARCH SUPPORT PROGRAM
OF NUTRITION AND FUNCTION

NUTRITION CRSP
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Documentation Coordinator
Office of Development Information
and Utilization
Bureau for Science and Technology
U.S. AID
Washington, D.C. 20423

In accordance with Article VII of the US AID Grant entitled "Nutrition Intake and Function", we are submitting herewith 1 copy of the 3rd Quarterly Progress Report. This report consists of a report of the Management Entity, reports of the three country projects, and a series of reports submitted by the Technical Advisory Groups.

Sincerely,

Judith B. Balderston

Judith B. Balderston
Deputy Program Administrator

JBB:py

Enc.

NUTRITION COLLABORATIVE RESEARCH SUPPORT PROJECT

Third Quarterly Report
(March 1 - May 31, 1982)

Functional Implications of Malnutrition (CRSP)

Project No. 931-1309

Third Quarterly Report
(March 1 to May 31, 1982)

During this period considerable progress has been made in the design of the collaborative study and in establishing working relationships in the three overseas sites.

Meetings for the design of components of the study were held in New Orleans from April 18 to April 23, 1982. Technical Advisory Groups (TAG's) met to prepare reports in each of the following areas: Food Intake, Nutritional Status, Social Performance, Reproduction, and Disease. TAG's on Cognition and Activity met prior to the New Orleans meeting. The report of the Technical Advisory Group on Statistical Design and Data Management (which was included in the Second Quarterly Report) served as foundation for these discussions. Minutes of the April meetings are included here along with the TAG reports which were drafted earlier and completed in May. Each group consisted of a representative of each country project and, in most cases, an outside consultant.

Suggestions for the collection of research variables, drafts of instruments, and procedures to be adopted at a later meeting, were included in the Technical Advisory Group reports. Aspects requiring further testing or modification in the field were identified. A meeting in June was planned so that the preliminary recommendations of the separate TAG's group could be incorporated into an interim research design and so that the development and testing of specific instruments could proceed during the summer months. It was also tentatively planned that after the late June meeting to be held in Berkeley, that a meeting of the Scientific Coordination Board and Institutional Council would take place in the Fall, followed later by the External Advisory Panel.

Work in the field has proceeded unevenly due to the delays in reaching final contractual agreements. The state of these agreements at the end of the quarter was as follows:

Mexico Project: Agreement was signed 4/23/82 between the Management Entity at the University of California and the University of Connecticut. The agreement between Connecticut and the Instituto Nacional de Nutricion Salvador Zubiron, Mexico, was being prepared in early June.

Egypt Project: Agreement was not signed until June 16, 1982 between California and Purdue. Agreement between Purdue and the Egyptian Ministry of Health was still pending at the time of this report.

Kenya Project: Long delays were experienced in signing the inter-campus agreement between California ME and UCLA. These delays were due to continued negotiations with respect to the UCLA budget. Negotiations

between UCLA and the University of Nairobi have also held up the official beginning of the work. It is expected that contracts will be completed by early July.

In spite of the contract delays, some work has proceeded in each of the countries. In Mexico, because of the presence of the facilities of the Institute of Nutrition and the full-time presence of one of the PI's on site, it has been possible to move rapidly into the geographical area of the study and to carry out ethnographic surveys of potential sites. Preliminary censuses of households have been conducted at each potential site so that plans of the study sample can proceed smoothly. The attached document which reports the results of the Connecticut-Mexico work gives details of their progress.

The Kenya project has carried out some site visits in the Embu district in order to explore possibilities for actual village sites. Three experienced field workers have been located in Nairobi since January, planning ethnographic surveys, preparing for mapping, demographic surveys, and the criteria for household selection. Preliminary forms have been prepared by the U.S. and Kenyan team jointly but because of contract delays preliminary surveys had to be deferred. It is hoped that these will begin early in the summer.

Work of the Egypt project was delayed by contract negotiations. Arrangements have proceeded for work to begin as soon as contracts between Purdue and California and Purdue and Egypt are completed. A PI of the Egypt project has spent several weeks in Cairo making preparations for beginning ethnographic surveys as soon as possible during the summer.

It is hoped that, with the completion of all contractual agreements, field work necessary to identify communities and households, to familiarize field workers with communities, and to develop instruments and training of field workers will proceed smoothly.

The dates of the fall meeting and target date for implementation of Phase II will be discussed in June.

Management Entity

As noted in the April minutes, because of the difficulty in appointing a prominent Nutritional Scientist as Program Director, the decision was made at the meeting of the Scientific Coordination Board to invite Judith Balderston, an economist with considerable experience in empirical analysis and data management, to become Deputy Administrator of the CRSP. Dr. Balderston's prior experience as director of a closely-related longitudinal study on the functional effects of the malnutrition, as well as other research related to education and nutrition in LDC's, and her management of other AID sponsored projects,

equip her to assume responsibility within the Management Entity. Dr. Balderston's appointment was to begin in June.

Dr. George Beaton served as Interim Director until early April when he returned to his permanent commitments at the University of Toronto. Dr. Beaton will continue to serve the CRSP as a consultant (at 25% time) to the Management Entity.

It is anticipated that other part-time consultants in data management and statistics will be employed when needed.

The Management Entity staff during April and May consisted of two full-time members, an Administrative Assistant in charge of business and financial management, and a Bookkeeper/Secretary. It is anticipated that a part-time typist will be employed as needed.

Judith Balderston's experience in the management and analysis of a longitudinal nutritional study will enable her to oversee the work of central data management of the core information. An additional staff member will be appointed to plan and carry out central data management activities.

Mexico Project

THIRD QUARTERLY REPORT, MARCH 1, 1982 - May 31, 1982

Our work is still located at the ex-hacienda Solis, 3 hours north of Mexico City. Our major contribution to the communities in the Valley of Solis is to improve the existing primary health care system. To this end, we have installed three medical personnel in the clinic at Solis, and are providing some medical supplies. We are also assisting by setting up a quality control system in the clinic diagnostic laboratory, conducting seminars attended by all medical personnel and the project field team. We have identified Health Committees, elected by each community, and plan to train these persons in primary health care and preventive medicine.

Accommodation already exists for four families and the permanent field team. Renovations are planned to existing buildings to provide accommodation for visiting project personnel, and a laboratory for the project. The laboratory will be used for the immunology and work capacity substudies.

A number of permanent project employees are in place. These include: Field Director (Dr. Alfonso Mata), Data Manager (Dr. Pesaj Goldfedder), Internist-Administrator (Dr. Raul Castillo), Field Physician (Dr. Homero Marinez), Medical Resident (Dr. Pilar Alvis), Nutritionist (Catalina Garcia), Comuter Scientist (Dr. Ricardo Moncada, part-time).

To date, the following statistics are available.

COMMUNITY	POPULATION	NO. FAMILIES	% FAMILIES WITH COMPLETE ANTHROPOMETRY	NO. FAMILIES WITH COMPLETE DIETARY DATA
San Antonio	1300	180	80	73
San Miguel	512	84	80	43
Cerritos	728	86	80	29
San Nicolas	858	147	15	0

Step 1 - Census

Health auxiliaries from Salud Publica, who were already familiar with the communities, were recruited to collect the census data. Seventeen of them worked for 10 days. The data collected in the census were: number of persons per household, family economic status, sex, date of birth (verified by birth certificates in most cases), ability to read or write, occupation, place of birth. These data were then compiled by computer, and data for each person (coded by household and individual) were printed onto computer forms. Anthropometric data were then entered directly onto these forms in the field.

Step 2 - Anthropometry

Anthropometric data are being collected by two groups of field workers. Each group contains a trained INN employee, and three community workers specially trained in anthropometric procedures. Anthropometric measurements include: weight, height, supine length (for children under 2 years), mid-upper arm circumference, and triceps skinfold thickness. Questions are also asked about current state of health, as diagnosed by the subjects, and stage of pregnancy and lactation. The methodologies were tested in a test community (Pueblo Nuevo). The majority of these data were collected in two ways: by visiting schools, and by setting up temporary anthropometry stations in the houses of community members. The response of community members has been excellent.

Step 3 - Dietary Data

The dietary team is headed by a nutritionist from INN, and is composed of five community workers especially trained for this project. The dietary questionnaire contains questions about:

i) foods typically consumed at breakfast, lunch and dinner. This information is only used to enquire about recipes of most frequently consumed foods.

ii) recipes of most commonly consumed foods, including weighing of ingredients and volume of utensils.

iii) questions on the consumption of 48 specific foods and beverages, including number of days on which consumed and amount consumed.

The methodologies were tested in a test community (Pueblo Nuevo). Each of the five persons in the dietary team collects the above information from the female head of five families each day. The questions are directed to the food intake of the female head of household, and at least one of her children between 2 and 5 years of age.

Data Analysis and Management

As explained below, the analysis of data from this preliminary phase of the research will be analyzed during July and August. We have been fortunate in acquiring the voluntary assistance of the research division of IBM. They are helping us to develop programs for data analysis and the production of questionnaires. We are using the computer at IBM in Mexico City, and storing the data on tapes. In the future, it is hoped that IBM will loan us a small computer for use in Solis, to be used for data entry and simple types of data analysis. Since we have already collected a relatively large amount of data, there is an urgent need for ensuring the compatability of our data management system, statistical packages, etc., with that of Berkeley and the other projects.

Tentative Timetable

June 4 - August 25	-Ethnographic survey (Drs.Pertti and Gretel Pelto and P. Guarnaccia in the field)
June 21	-Finish collection of anthropometric data
June 25	-Finish collection of dietary data
June 28 - July 9	-Data cleaning -Repeat dietary data collection on 50 families to assess reliability of "habitual intake" questionnaire -Intra-individual variability in food intake, on 10-20 families

June 28 - July 9 (Cont.)	-Development of immunology techniques to be used in the field laboratory, and visit by Dr. Chandra -Field testing of cognitive tests (Dr. G. Findley in in field, testing in a pilot community)
September	-Training of personnel for work capacity studies

It appears unlikely that we will be able to start working with our selected families until sometime between September and December. The reason for this is that we want to ensure long-term cooperation from the households, and equally important, from community leaders. In order to ensure the support of the leaders, we are developing a plan with them in order to improve the public health of the communities. This plan is still in the process of being developed, but will probably take the form of providing such services (with the assistance of Salud Publica) as fecal analyses for parasites and subsequent treatment, the training of community personnel in primary health care and preventive medicine, identification of major health problems in the community, etc..

Budget

To date, no funds from the University of California, Berkely, have reached Mexico. We have a small advance from the University of Connecticut, but the need for further funds is immediate. Mr. David Herman, Grants and Contracts Director from the University of Connecticut, visited INN May 11-14, in order to set up the process for financial management of the project. The subcontract between INN and University of Connecticut was signed on May 14. On May 14, we also submitted our proposed budget for the months of May - July to the University of Connecticut, in order to apply for advance funds for these 3 months. While it appears that some of these funds will appear in Mexico during the next few weeks, money for the purchase of equipment and for renov.tions has been withheld, pending our submission of a detailed equipment list and budget. Unfortunately, the preparation of this list has been slow. The rate of inflation in Mexico is such that the prices of all equipment have

to be obtained from the manufacturers - catalog prices are unrealistic. In the meantime, the delay in receipt of these funds is causing great frustration due to our inability to purchase vehicles and renovate laboratories and living space.

If Berkeley has special forms on which to make these budget requests, and rules for obtaining approval for the purchase of specific items (including approval from AID), we would appreciate receiving a copy of these. The present system of trial and error on our part is extremely frustrating and inefficient.

9

THIRD QUARTERLY REPORT
Egypt Project
Nutrition CRSP
March 1 - May 31, 1982

1. Country Project Status

During the period from March 1 - May 31, 1982, the Purdue, Arizona, and Kansas scientists involved in the Egypt Nutrition CRSP project devoted most of their effort to developing and refining methodological approaches and data-gathering instruments for use in the study, and to cementing relations among the many individuals and institutions directly involved in this huge undertaking.

Purdue University directed considerable effort toward finalizing contractual agreements between Purdue University and the Management Entity (University of California). A preliminary draft of the contract between Purdue University and the Egypt Ministry of Health was discussed with Dr. Hekmat Aly at the SCB meetings in New Orleans for the purpose of facilitating future negotiations with the Ministry of Health. Only limited work is possible until contracts and field arrangements are finalized.

2. Participation in Technical Advisory Groups

Harrison, Jerome, Kirksey, Ricci, Ritenbaugh, and Watson participated in the April meetings of the Nutrition CRSP Technical Advisory Groups in New Orleans, Louisiana. Jerome and Ricci participated in the TAGs on Social Competence and Food Intake; Ritenbaugh also participated in the Social Competence TAG. Harrison participated in the TAGs on Food Intake and Nutritional Status; Kirksey and Ritenbaugh participated in the TAG on Reproduction, and Watson participated in the Disease/Immunology TAG.

Jerome assumed the lead role in developing concepts, methodological approaches and measures of social performance. A report based on the Social Performance TAG meeting held in New Orleans and additional work, prior to and following the meeting, has been submitted to the Management Entity and sent to all Nutrition CRSP P.I.s. In addition, Kansas also contributed a provisional Household Food Inventory/Individual Food Intake Data-Gathering Instrument. Copies of this have been sent to the Management Entity and P.I.s for review and comment.

Kirksey prepared a working paper on lactation, which included a review of literature, for her participation in the Reproduction TAG meeting at New Orleans in April. Decisions were reached about the parameters to be measured during pregnancy and lactation and which relate to pregnancy outcome and lactation performance. These measurements were developed in relation to those proposed by other TAGs such as disease/immunology, activity/work performance, and nutritional status.

In the Disease/Immunology TAG, a concise work plan was developed to allow for only minimal intrusion into the family. Measures of disease status or immunological responsiveness were selected on the basis of samples collected in the core measurements and interactions with other variables.

Ismail and Kolgemuth attended some of the TAG meetings in New Orleans for the purpose of gaining a better understanding of the areas of work.

The University of Arizona responded to Dr. Helmat Aly's request for a brief description (protocol) of the Egypt Nutrition CRSP. This description will be used in Egypt and shared with the Egyptian Minister of Health and with Nutrition Institute personnel. In addition, the University of Arizona distributed copies of the CDC Tape to UCLA and the Management Entity.

In addition, the Arizona group developed a revision of the field manual for standardizing anthropometric measurements. This revision will be sent to Nutrition CRSP P.I.s by mid-June. Arizona has also obtained approval of their revised protocol from the Arizona Human Subjects Review Committee.

Wolgemuth has compiled information on microcomputers for field use. Watson has collected background information on methods for immunological assessment assays from the literature and from FASEB meetings. Kirksey has worked with a graduate student on methodologies relating to lactation, including test-weighing procedures. A paper was presented at FASEB meetings in April. The student will complete the requirements for the Ph.D. degree in December 1982 and may continue to work as a post-doctorate on some of the methodologies to be used in field studies for Reproduction/Lactation in Egypt.

3. Other Activities

The status of other aspects of the Egypt project are as follows. Harrison traveled to Cairo on May 24, 1982 to work with the Egyptian colleagues regarding the start up of the CRSP. She intends to return on June 21, 1982 and will spend two days at Purdue with Jerome and the Purdue scientists in debriefing and developmental sessions. Jerome plans to work in Egypt from mid-July to the end of August.

Wolgemuth continued the development of the Egypt CRSP resource library. Also, she has consulted with on-campus (Purdue) and off-campus personnel who have had work experience in Egypt or the Middle East. Wolgemuth has assisted in planning and administrative matters relating to Nutrition CRSP.

Negotiations with counterpart institutions are ongoing and continuing with respect to budget and preliminary field work. Both Arizona and Kansas

feel that protracted budgetary negotiations between Purdue and Californi- continue to impose severe limitations on the Egypt project.

Submitted by: Norge W. Jerome for Gail G. Harrison
June 18, 1982

13

QUARTERLY REPORT
March 1 to May 31, 1982
~~April 1st - June 30, 1982~~

Kenya Project

U.C. Berkeley - UCLA - Univ. Nairobi

A. Field Activities in Kenya

U.C. Team

Dr. Dorothy Cattle - field nutritional anthropologist

Dr. Eric Carter - field nutritionist

Dr. Fred Zerfas - short-term assignment to help with implementation phase of preliminary survey. April 13, 1982 - June 5, 1982 in Kenya

University of Nairobi

Dr. James Kagia, Principal Investigator

Dr. Nimrod Bwibo, Co. P.I.

Dr. A.A. Jansen, Nutritionist, Medical Research Center - about to join Medical School and Ministry of Health

Dr. J. Meme

Dr. S. Kinote

All of the above have been involved to varying degrees in field site visits and planning of the preliminary survey.

Computer Center - Chiromo Science Campus, Univ. of Nairobi

Mr. N. Corkhill and Professor Scott, Director have been assisting the group in form design and plans for data analysis of preliminary survey.

Selection of Project Site

A number of site visits were made to Embu district by the U.C. team and Drs. Kagia, Meme, Kinote and Jansen at various times in April, May and June. Consultation was obtained from eastern province Principal Medical Officier (Dr. Oyoo) and the nutritionist and Central Bureau of Statistics provincial statistician, and Embu District Health officer, community nutrition workers, Public Health technicians (sanitarians) and sub-location chiefs. An area of about 2 miles wide and 5 miles long which is inhabited by one tribe, the Embu, and which is fairly well populated was chosen as an exploratory site. The terrain goes from a highland area of about 6000 feet (tea growing, cool area) through a coffee growing area of about 4000 feet, down to a semi-arid area of

about 2000-3000 feet. A rural health training center and Health Center at Karurumo is in the semi-arid area and a health center at Runyenjes, in on the northern border. Karurumo center, in particular, has ample space to accommodate classrooms for training, a project laboratory, work space and limited staff housing. Another advantage is that there is electricity and a piped-safe water supply. The Karurumo and Runyenjes site locations both have very cooperative and forward looking chiefs and 2 excellent community nutrition workers.

There are an estimated 1200 households or homesteads which tend to be scattered, from 50 yards to 500 yards apart.

Tentative plans are as follows:

(1) Mapping of household locations: Possibly this will be accomplished with the aid of aerial photography. Households will be numbered.*

(2) Demographic information will be gathered from each household as it is numbered and registered.

(3) After the basic census the area will be divided into 3 strata, based on geographic and demographic considerations.

(4) About 200 households will be picked by cluster sampling from those households containing fertile females and/or children under five years of age.

(5) Initially 20 to 30 households will be picked from each strata and the household findings evaluated using the preliminary survey instrument (see appendix) such as the range and relative frequency of various levels of food intake and nutritional status.

(6) Depending in what is found above, the remainder of the cluster samples in each strata will be completed. Cluster sampling is important in an area with such widely scattered honesteads.

(7) After analysis of the data from the preliminary survey, 300 households will then be picked from the 600 for the definitive study.

Preliminary Form Preparation

This has now been underway for 3 months with heavy input from the Kenyan side. The form will be duplicated in Nairobi and pre-coded. The instrument was tested in several households and takes about 50-60 minutes excluding any blood work (hemaglobin, thick smears for malaria) or stool examinations.

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*This will only be done after all permissions and clearances are finalized and local permissions obtained from the Chief, Sub-Chiefs and community.

15

Data Analysis

The plan is to use the Univ. of Nairobi computer facilities in the main science campus at Chiromo. This facility has been described earlier. The facility appears to be able to handle the data from the preliminary survey but its capabilities for future work will be assessed during the preliminary survey.

Time Frame

A delay has occurred which will result in a delay in starting the preliminary survey. There has been a hold-up in getting the subcontract signed with the University of Nairobi. This has been attributed to the fact that is a new dean and a new faculty council who had to review the project once again. The subcontract should be signed any day now. However, there can be no funds transferred to the University of Nairobi to hire field staff and start their training until the subcontract is signed. The clearance from the Office of the President is still pending dependent in the Medical School Clearance. In a recent telephone conversation with Dr. Bwibo* he said that the above approvals were rapidly forthcoming. A deadline of June 30 for obtaining these approvals was given before intervention by higher authorities would be requested.

Logistics, Equipment and Supplies for the Preliminary Survey

Vehicles: A USAID waiver was obtained in June for the purchase of a used Toyota Landcruiser from UNICEF in Nairobi as well as the ordering of 2 new Toyota station wagons through the UNICEF "Reimbursable procurement Plan." It will take about 4 months to receive the new vehicles.

A number of scales, hematology equipment, arm tapes, calipers, calibrating weights and other office supplies and equipment have been brought in duty-free by Drs. Fred Zerfas, A. Neumann and originally with E. Carter and D. Cattle. Additional items will be air freighted and can be brought in duty-free through the Medical School for the time being.

Drs. Carter and Cattle has established residencies cum offices in Embu and Runyenjes and starting to furnish and set up work space.

Personnel

Further personnel recruitment cannot start immediately but sources of field workers are being identified and job descriptions being written.

Training manuals have been drafted and are being refined as well as schemes for quality control.

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*Dr. Kagia was away.

TAG Report Critiques

Drs. D. Cattle and E. Carter and Dr. Kagia and Bwibo, but particularly the U.C. staff have been performing a valuable service for the M.E. and other investigators. Having now been in the potential study area and seeing the work setting up close they have been critiquing the TAGS from their own vantage points as the people who will be expected to carry out many of the studies. Many of their points are extremely valuable and valid although some of their comments may not be, as they lack perspective. Their various concerns are:

(1) To reduce the core measurements to absolute minimum - to do fewer but well performed measures.

(2) To have specific procedures, equipment, supplies, personnel needs, timing, frequency of tests be made absolutely clear and specific.

(3) To consider costs of the above.

(4) To integrate data collection from several TAGS since there is considerable overlap, especially for cognitive function, social performance and work performance. It is recommended that their critiques be widely circulated to other projects.

B. Activities at UCLA/UC Berkeley

1. Writing of TAGS and critiquing others: Reproduction (King); Disease (Neumann).

2. Ordering of supplies, equipment and arranging for shipping, etc.

3. Arranging for transfer of funds to Kenya for U.C. staff for field expenses. An Official Univ. of California/UCLA Account has been opened in Nairobi which required Regental approval.

4. Preparation for and attendance at ME meeting, June 26-28, 1983 at U.C. Berkeley.

5. Human Subject Protection Committee was granted an "Umbrella Approval" for the CRSP. Each new protocol as it is produced must be approved by the "Human Use" committee.

6. Personnel

   a. Recruitment of field staff.

      (1) A third field nutritionist - to supervise quantitative food intake and lactation studies.

      (2) Field Coordinator - The Kenyans have strongly urged that a physician with Public Health and nutrition field research experience be recruited.

b. Co-Investigators - Finalization

Work Performance: Dr. Gerald Gardner: UCLA, Prof. of Kinesiology. Dr. Gardner has had extensive field research experience in rural Venezuela and Shri Lanka researching the effects of iron deficiency on work performance among tea plantation workers and among other rural groups.

Cognitive Function: Dr. Emmy Werner: UC, Davis. Dr. Werner has had extensive research experience in cross-cultural settings on child development and cognitive function.

Dr. A. Afifi, Professor of Statistics, UCLA.

Dr. Afifi has had extensive experience with nutrition and health projects both in USA and developing countries. He will be invaluable in design and analysis.

Dr. Anne Coulson, UCLA

Data management and flow and design and epidemiology. Dr. Coulson is also acting as consultant to the M.E.

Dr. E. Richard Stiehm, Immunology, UCLA.

Dr. Stiehm has had extensive experience in Ghana and Kenya working on immunologic aspects of malnutrition.

Dr. James Cherry, Infectious Disease, UCLA. Dr. Cherry has worked on a measles immunization study in Kenya.

Dr. Cherry will involved in setting up studies for rotovirus and respiratory syncytial virus and measles.

Dr. Claudia Carr, UC Berkeley.

Dr. Carr will be invovled with the component on social performance and socioeconomic studies. She has prolonged an in depth experience in East Africa and has expertise in social science.

Dr. Janet King, UC Berkeley.

Dr. King is most involved with reproductive aspects of the study, especially lactation. She is also the acting co-principal investigator for U.C. Berkeley group. A decision will be made as to whether or not she will continue past July 1982 or will be replaced by someone else at U.C. Berkeley.

Training Activities

Dr. Julius Meme of the University of Nairobi has been at UCLA from May 7 remaining to late July. He has been receiving short-term training at UCLA in Child Development with Dr. Arthur Parmalee. He is here to especially learn Bayley Infant Testing and Brazelton Newborn Testing. Dr. Meme has completed

a formal workshop on Bayley Testing at U.C. Berkeley. He has conferred with Dr. Leiderman at Stanford University who has done Child Development Studies in Kenya and he conferred with Dr. Emmy Werner, his counterpart while he was in Berkeley. Dr. Meme is also giving valuable input into project planning with the U.C. group in California. Dr. Meme will also receive instruction on an introduction to the compter set up by Dr. Anne Coulson.

Summer Plans 1982

Dr. Charlotte Neumann will spend 8 weeks in Kenya, approximately July 10th to Sept. 7 to implement and carry out the preliminary survey.

Appendices

Preliminary Survey Proforma - rought draft
Kenya field report site visit

PROF. C. A. ELIAKIM

P. 10/4

NUTRITIONAL RESEARCH PROJECT UN/UCL/UCB

REPORT ON THE VISIT TO EMBU DISTRICT 7/4/82 TO 8/4/82

PARTICIPANTS: DR. S. KINOTI, DR. J. MEME, DR. D. CATTLE AND DR. H. CARTER:

The main purpose of this visit was to measure the length and weight of children (approximately 0 to 60 months old) attending various clinics at two health centres in the district. Runyenjes (7/4/82) and Kurururo (8/4/82). These centres were chosen because they are located near the higher and lower limits respectively of our proposal preliminary survey location. Length for age as a measure of stunting and so of chronic undernutrition and weight for length as a measure of wasting and so of acute undernutrition were calculated for each child at each health centre. The pooled results are shown on Tables land 2 (attached).

Stunting is more prevalent than wasting. This was specially true of the children attending the Runyenjes Health Centre where 27% of all children had length for age values below - 3 standard deviations from the reference median.

On the basis of this albeit scanty information it seems that the prevalence of children experiencing a range of stunting from mild to "severe" together with the presence of appreciable numbers of apparently well nourished children is consistent with the preliminary survey requirement which is to identify an area where the intake of dietary energy ranges from adequate to chronically inadequate. Thus the general area served by the two health centres would be suitable for the preliminary survey.

On our way back through Embu town we informed the P.C.M. Dr. Oyoo of our progress and visited the M.O.H. Dr. _____ and the Nutritional _____ of Embu District Hospital with whom we discussed several aspects of rehabilitation P.E.M.

DATE:

DR. E. CARTER.

P 30/4

TABLE 1

RUNYENJES HEALTH CENTRE 7/4/82

Children attending morning malnutrition clinic and afternoon well-baby clinic were weighed and measured.

LENGTH FOR AGE (SD* SCORE) [(#),%]

AGE (mos)	More than -1	-1to-1.99	-2to-2.99	≤ -3	TOTAL
0 to 5.9	(11) 17%	(6) 9	(1) 2	0	(18) 27%
6 to 11.9	(3) 5	(6) 9	(3) 5	(5) 8	(17) 24
12 to 23.9	(6) 9	(3) 5	(4) 6	(3) 5	(16) 24
24 to 47.9	(1) 2	(1) 2	(1) 2	(7) 11	(10) 15
48 up	(1) 2	(1) 2	0	(3) 5	(5) 8
TOTAL	(22) 33%	(17) 26	(9)14	(18) 27	N=66

WEIGHT FOR LENGTH (SD SCORE) [(#),%]

AGE (mos)	More than -1	-1to-1.99	-2to-2.99	≤ -3	TOTAL
0 to 5.9	(15) 21	(3) 5	0	0	(18) 27
6 to 11.9	(12) 20	(4) 6	(1) 2	0	(17) 24
12 to 23.9	(6) 9	(7) 11	(3) 5	0	(16) 24
24 to 47.9	(3) 5	(4) 6	(3) 5	0	(10) 15
48 up	(3) 5	(1) 2	(1) 2	0	(15) 8
TOTAL	(39) 59	(19 29	(8)12	0	N=66

LENGTH FOR AGE (SD SCORE) [(#), %]

WEIGHT FOR LENGTH (SD SCORE)	More than-1	-1to-1.99	-2to-2.99	≤ -3	TOTAL
More than-1	(15) 23	(11) 17	(6) 9	(8) 12	(40)61
-1to-1.99	(5) 8	(5) 8	(1) 2	(6) 9	(17)26
≤ -3	(2) 3	(1) 2	(2) 3	(4) 6	(9)14
TOTAL	0	0	0		(0) 0
	(22) 33	(17) 26	(9) 14	(18) 27	

* SD Scores based on the WHO/UCHS Reference Data
n=71, ♀ = 39(55%), ♂ = 32(45%)

• SD SCORE BASED ON THE WHO/NCHS REFERENCE DATA

n=71; Q= 39 (55%), Q*=32(45%).

TABLE 2:

KARURUMO HEALTH CENTRE 8/4/82

Children attending morning MCH clinic were weighed and measured

LENGTH FOR AGE (SD SCORE) ( ), %

AGE (mos)	More than -1	-1to-1.99	-2to-2.99	≤-3	TOTAL
0 to 5.9	(10) 31%	(2) 6	0	0	(12) 38%
6 to 11.9	(2) 6	(2) 6	(2) 6	0	(6) 19
12 to 23.9	(2) 6	(2) 6	(1) 3	0	(6) 16
24 to 47.9	(1) 3	(2) 6	(5)16	0	(8) 25
48 up	0	0	0	(1) 3	(1) 3
TOTAL	(15) 47%	(8) 25	(8)25	(1) 3	≤=32

WEIGHT FOR LENGTH (SD SCORE) [( ), %]

AGE (mos)	More than -1	-1to-1.99	-2to-2.99	≤-3	TOTAL
0 to 5.9	(6) 19	(2) 6	(1) 3	(3) 10	(12) 39
6 to 11.9	(4) 13	(2) 6	0	0	(6) 19
12 to 23.9	(2) 6	(2) 6	(1) 3	0	(5) 16
24 to 47.9	(3) 10	(1) 3	(1) 10	0	(7) 23
48 up	(1) 3	0	0	0	(1) 3
TOTAL	(16) 52	(7) 23	(5) 16	(3) 10	=≤31

LENGTH FOR AGE (SD SCORE) [( ), %]

WEIGHT FOR LENGTH (SD SCORE)	More than-1	-1to-1.99	-2to-2.99	≤-3	TOTAL
More than	(6) 19	(3) 10	(5) 16	(2) 6	(16) 52
-1to-1.99	(5) 16	(2) 6	0	0	(7) 23
-2to-2.99	(1) 3	(2) 6	(2) 6	0	(5) 16
≤-3	(3) 10	0	0	0	(3) 10
	(15) 48	(7) 23	(7) 23	(2) 6	

n=34; ♀=20 (59%). ♂=14 (41%).

PROF C NEU.

NUTRITION RESEARCH PROJECT UN/UCLA/UCB P. 1/2

REPORT ON THE VISIT TO EMBU DISTRICT 31/3/82 to 1/4/82

PARTICIPANTS: PROF. J. KAGIA, PROF. A.K. NEUMANN, DR. D. CATTLE, DR. J. MEME AND DR. E. CARTER

31/3/82 : We met and discussed the project with the following people: the Runyenjes D.O. Mr. J.G. Mukinja, the Kyeni location Chief Mr. F.W. Nthambiri and some of his sub-chiefs in Kathanjuro. We then drove to Siakago and met the Clinical Officer Mr. W. Nyaga at the Health Center. We agreed to return the next day to meet the Nutrition Field Workers. On our way back to Embu we stopped at Karurumo Health Training Center and arranged to return the next day.

1/4/82 : Professor Kagia returned to Nairobi. Further meetings were held with the Gaturi location Chief Mr. N.N. Nyaga and some of his sub-chiefs. We reported back to the Runyenjes D.O. Mr. Mukinja and met again with the Kyeni location Chief Mr. Nthambiri. We were also introduced to the Kagaari location Chief Mr. J.K. Njeru.

We proceeded to the Runyenjes Health Center and met the Clinical Officer Mr. Kingori. We then drove to the Karurumo Health Center and met the Clinical Officer Mr. Mbogo and the Nutrition Field Worker Mrs. A.W. Namu. Together with Mrs. Namu we drove back to Siakago to introduce ourselves to the Siakago D.O. Mr. F. Karimba and the Nthawa location Chief Mr. E. Ndathi. Mr. Karimba was anxious that we disseminate the information we collect locally. At the Siakago Health Center we were introduced to the two Nutrition Field workers, Mrs. S. Muguru and Mrs. T. Wariara, who accompanied us on a visit to a poor compound in Riandu location.

We were encouraged by the welcome extended to us by all those we met. The discussions with the various officials and in particular with the Clinical Officers and the Nutrition Field workers gave us valuable information on the type of malnutrition prevalent in these communities. PEM together with oedema was recognised as being a major problem in the under fives. By driving around we were able to obtain first impressions as to the suitability of the area for the project from the point of view of logistics.

DATE:

DR. E. CARTER

PROF. NEUMANN

Carter and

Cattle

Nutrition CRSP - Kenya Project

UN/UCB/UCLA Project Investigator Meeting

Minutes - April 15, 1982 - 11:30 a.m.

Department of Community Health, University of Nairobi.

Agenda circulated:

a) Reading of minutes of previous meeting

b) TAG - Socio-economic

c) Social competence

d) Economic variables

e) Social variables

f) Measurements of children in field - Dr. Carter

g) Topics of study

a) Written minutes for previous meeting were not available.

b) TAG - Socio-economic issues raised: need for it and project representation; information will be gathered as part of other functional areas; CRSP materials have already indicated the types of information needed across projects; do not consider it warrants a separate TAG or separate definition as a "functional area"; project investigators in Kenya must consider their representation at any socio-economic discussion meeting. Therefore, advise need further intra-project information from US personnel and consider it non-advisable to establish this TAG.

c) Social competence

Household level

1. Household management - assessment or evaluation of housekeeping and childcare characteristics of indiv.

households (possibly conducted by a public health nurse).

2. Social activities - adult family members social and community participation as indicated by membership in organizations (church, co-ops), participation on committees (school committees) and in projects (harambee), attendance at meetings and at markets, and use of community facilities and institutions (health facilities).

3. Problem-solving-wife and husband interaction to make decisions on three major family problems: (a) children' education; (b) food selling from household produce; and (c) what is planted and where.

d) Economic variables - Kenyan perspective concerned with the role of agriculture in food which has implications for a national food policy; suggestion has been made that such a policy be a nutrition policy. Therefore CRSP Kenya project takes special interest in food production in study area.

e) See discussion under b).

f) Measurements of children -

1. Anthropometric measurements reported in trip report for 7/4/82 - 8/4/82; see discussion therein regarding selection of field study area.

2. Expect seasonal shifts on individual level in anthropometric parameters (expect more shifts in weight for ht. than length for age).

3. Expect to have to increase sample size to allow for such shifts; request statistical advice.

4. Household classification - major question raised: in classifying households (for the main study) as moderately malnourished to well-nourished, how much reliance will be placed on the anthropometry of the under-fives (as opposed to individuals/household food intake and other determinants of a household's nutritional classification) in other words, what will the classification procedure be? This has important implications in the sample size for the preliminary survey.

g) Topics of study -

1. Under-fives morbidity: 2 aspects - at household level, recalled morbidity; at clinic level, recorded morbidity. Relationship between episodes of household morbidity and clinic morbidity.

2. Chronic morbidity - initial definition of chronic is person ill more than 3 mos. Three steps:
a) collect morbidity at household level by individual recall; identify person(s) and their complaint(s);
b) those so identified are called to a special clinic and given complete physical exams; (c) alternative - pick randomly persons to be examined in order to describe chronic morbidity pattern. Raised question about relating chronic illness to food intake.

Selection of Field Study Area CRSP Criteria for Selection.

1. Stability - on basis of preliminary evidence, expect:
   a) low migration rate
   b) moderate labor translocations for adult males (a characteristic of the Kenyan situation).
   c) little possibility of major socio-political disruptions.

2. Homogeneity - (a) expect small tribal differences which will be identified and quantified.
   (b) water and health facilities - fairly evenly distributed throughout study area.

3. Appropriate Size - adequate; question raised: is 1500 households in the study area an adequate base from which to select the 600 households for the preliminary survey? Expect vital and demographic characteristics to be similar throughout; area poses an invironmental gradient.

4. Appropriate Range of Nutrient Intake - 1. on basis of the reported anthropometric measurements and discussions with local health personnel, expect appropriate range of nutrient intake.
   2. ability to over - represent well-nourished and moderately malnourished as suggested by the statistical TAG.
   3. Reproductively - active females and pre-school children well represented.

4. Infrastructure - 1. local governmental and health personnel and community leaders have expressed interest and support for project; 2. logistics adequate.

5. Other conditions - anticipate unstable malaria (malaria increases during rainy season and decreases during dry season).

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PROF. C. NEUMANN
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NUTRITION CRSP - KENYA PROJECT
DEPT. OF COMMUNITY HEALTH - UNIV.
OF NAIROBI MEDICAL SCHOOL

BACKGROUND INFORMATION
FIELD SITE

I. MAPS (see attached)

II. POPULATION - BY SEX AND SUB-LOCATION
EASTERN PROVINCE

(1979 CENSUS)	MALE	FEMALE	TOTAL	# OF HOUSEHOLDS	SQ. KMS.	DENSITY
EMBU DISTRICT	123,861	145,306	269,173	50,241	2,714	96
RUNYENJES DIVISION	71,969	76,162	148,131	25,291	446	332
KYENI LOCATION	14,896	16,049	30,945	5,013	98	313
SUBLOCATIONS:						
KATHANJURI	2,334	2,499	4,833	799	8	569
KAKURUMO	1,610	1,631	3,241	579	17	182
KASAFIRI	260	298	558	107	8	66
SUBLOC. TOTALS	4204	4428	8632	1485	33	[illegible]

III. PHYSICAL DESCRIPTION

ALTITUDE RANGE: APPROX. 1460 m - 1020 m
KATHANJURE - NEAR CHIEF'S OFFICE - 1437 m
KAKURUMO - EAST OF HEALTH CENTER - 1241 M
KASAFIRI - WEST OF SCHOOL - 1173 M

WATER COURSES: GALHUNGA RIVER, KAKURUMO RIVER, TEMBUGO RIVER, LOWER TRIBUTARIES & STREAMS, ENA RIVER

OTHER FEATURES: ONE DEPRESSION AT APPROX. 1460 M. IN KATHANJURE; SEASONAL SWAMPS IN KAKURUMO BETWEEN APPROX. 1320 - 1240 M.

LAND NOT CULTIVATED IS INDICATED BY SCATTERED TREES; SCRUB LAND BEGINS AT VERY SE BOUNDARY OF KASAFIRI.

MAN-MADE FEATURES INCLUDE: [illegible], DRY WEATHER ROAD, CHIEF'S OFFICE, CATTLE DIP, WATER DEPOT, WATER PIPE LINE, WATER-MILL, WATER TANK, CHURCH, COFFEE FACTORY, POWER LINE, TEA SUBSTATION, MURRUM ROAD, DRY WEATHER ROAD, CULVERT, HEALTH CENTER, UNFINISHED SECONDARY SCHOOL, HOUSES, CULTIVATED FIELDS.

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IV. HOUSEHOLDS

DEFINITION: POLYGAMOUS HOUSEHOLDS WILL FORM A COMPOUND. DEFINITION WILL FOCUS ON 'THOSE WHO EAT TOGETHER = SHARE COOKED FOOD.'

STRUCTURE: POLYGAMOUS HOUSEHOLDS EXPECTED BE BETWEEN 5% AND 15% OF POPULATION; FEMALE-HEADED HOUSEHOLDS ARE LIKELY TO EXPERIENCE LIFE-CYCLE IN MICROCOSM. HOUSEHOLDS ARE LIKELY TO EXPERIENCE THEIR CHILDREN. AVERAGE NUMBER OF CHILDREN UNDER 15 YRS. EXPECTED: 3 CR 4/HH.

PHYSICAL DESCRIPTION

HOUSING: WALLS - MUD, SUN-DRIED BRICK, WOOD, TIN, STONE
ROOF - THATCH, TIN, TILE
FLOOR - DIRT, CEMENT
WINDOWS - NONE TO APPROX. 3; US. NO GLASS OR SCREEN
ROOMS - US. 1 OR 2.
KITCHEN FACILITY - MAY BE SEPARATE; WOOD FIRE COMMON
UTILITIES - US. NONE TO HOUSE
TOILET FACILITY - SAME DEPENDING ON WEALTH
REFUSE DISPOSAL - US. IN GARDEN; REFUSE PIT OR BURNED
COMPOUND - MAY CONSIST OF SEVERAL HOUSEHOLDS OR A HOUSEHOLD WITH SEVERAL SECONDARY BUILDINGS CLUSTERED TOGETHER

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IV HOUSEHOLDS (CON'T)

AGRICULTURE

FIELDS US. SURROUNDING COMPOUND OR HOUSEHOLD; MORE DISTANT LAND MAY BE OWNED OR WORKED

LIVESTOCK - CATTLE, GOATS, SOME CHICKENS, DONKEYS, OXEN; GRAZED & WATERED DURING DAY; PENNED IN COMPOUND OR AT NIGHT; SOME ANIMALS MAY BE BROUGHT INTO HOUSE AT NIGHT.

V. HEALTH FACILITIES & PERSONNEL.

FACILITIES: DISTRICT HOSPITAL - EMBU TOWN
AMBULANCE; MOBILE CLINIC.
MISSION HOSPITAL - KYENI HOSP. (R. CATHOLIC).
PRIVATE -
HEALTH CENTERS - KUNYENJES RURAL HEALTH CENTER - KUNYENJES TOWN
- KARURUMO RURAL HEALTH
TRAINING CENTER - KARURUMO.
MOBILE CLINICS & AMBULANCE SERVICE HAMPERED BY LACK OF MONEY.

PERSONNEL: HEALTH & MEDICAL PERSONNEL AT PROVINCIAL & DISTRICT LEVELS HEADQUARTERED IN EMBU TOWN; FOR EXAMPLE: PMO (PROVINCIAL MEDICAL OFFICER) HAS AN INTEREST IN NUTRITION, PNO NURSING OFFICER HAS INTEREST IN CHILD MORBIDITY & EFFECTIVENESS OF MCH (MATERNAL & CHILD HEALTH) CLINICS; MOH (MEDICAL OFFICER OF HEALTH) & CLINICAL OFFICER AT DISTRICT HOSPITAL HAVE CONCERNS WITH TREATMENT OF MALNOURISHED CHILDREN ADMITTED TO HOSPITAL. BOTH HEALTH CENTERS HAVE A NUTRITION WORKER, A CLINICAL OFFICER, VARIOUS PUBLIC HEALTH OFFICERS (MALARIA & SANITATION/HYGIENE) AND NURSES.

PROGRAMS: FACILITIES HAVE CHILDREN PROGRAMS WHEN MONEY & TRANSPORT PERMIT, NUTRITION WORKERS MAKE HOME VISITS; KARURUMO HAS CLASSROOM, STUDENT HOSTEL, DINING ROOM TO RUN TEACHING/TRAINING PROGRAMS FOR RURAL HEALTH WORKERS.

VI. ECONOMY

LAND DEMARCATION APPARENTLY HAS BEEN ACCOMPLISHED THROUGHOUT STUDY AREA; POPULATION MOVEMENT IS FROM HIGHER, DRIER, MORE DENSELY SETTLED AREAS TO LOWER, MOST MARGINAL, DRIER, SPARSELY POPULATED AREAS OF EMBU DISTRICT.

MAJOR CASH CROPS (FROM HIGH ELEVATION TO LOWER AREAS) ARE: TEA, COFFEE, COTTON, TOBACCO

OTHER CROPS INCLUDE: MAIZE, MILLET, SORGHUM, BEANS (SEVERAL TYPES), PEAS (COW & PIGEON); ALSO GROWN ARE BANANAS, ENGLISH POTATOES, CABBAGE, KALE, TOMATO, ONION, CARROT, MANGO, PAWPAW, YAM, SWEET POTATO, CASSAVA, TARO, SUGAR CANE, PUMPKIN.

MARKETING: LOCAL MARKETS: US. HELD ONE DAY A WEEK AT PARTICULAR LOCATIONS; FOODSTUFFS & HOUSEHOLD GOODS SOLD, LIVESTOCK AT LARGER MARKETS; MARKET US. SITUATED IN AREA SURROUNDED BY SMALL RURAL SHOPS AND OFTEN ON A MAJOR ROAD.

CO-OPERATIVES - SOME MAJOR CROPS, SUCH AS COFFEE, ARE REGULATED AND SOLD THROUGH A CO-OPERATIVE ASSOCIATION.

VII. EDUCATION

RURAL PRIMARY SCHOOLS ARE SCATTERED THROUGHOUT STUDY AREA; SECONDARY SCHOOLS ARE FEWER.

FAMILIES MUST PAY SCHOOL FEES AND BUY SCHOOL UNIFORMS FOR THEIR CHILDREN.

SOME PRIMARY SCHOOLS HAVE SCHOOL GARDENS.

SCHOOL BUILDINGS MAY BE COMMUNITY-BUILT; SCHOOL SUPPLIES & EQUIPMENT ARE SCARCE.

CHILDREN WALK TO SCHOOL.

VIII. RELIGION

VARIOUS PROTESTANT DENOMINATIONS AND A CATHOLIC MISSIONARIES HAVE BUILT MANY CHURCHES IN STUDY AREA; THESE CHURCHES MAY BE THE MOST SUBSTANTIAL, PERMANENT BUILDING IN THE AREA. ONE SOCIAL ORGANIZATION ESTABLISHED BY THE CHURCH IS A LOCAL MOTHERS' UNION.

INFORMATION FROM COMMUNITY DIAGNOSIS PAPERS (CONDUCTED IN VARIOUS PARISHES BY MEDICAL & HEALTH STUDENTS)

KARUEUMO GROUP - 8-14/7/79 - 272 HOUSEHOLDS = 1725 PERSONS
AREAS: KANYUAMBORA*, KATHANJURI, KASAFARI
MIGRATION RATES: LOW
DIVORCE RATE: LOW
KARUEUMO: APPROX. 49% OF POP. IS 15 YRS OR YOUNGER
KENYA : APPROX. 47% OF POP IS 15 YRS OR YOUNGER
GEN. FERTILITY RATE ($\frac{\text{\# OF LIVE BIRTHS} \times 1000}{\text{\# OF FEMALES 15-45 YRS.}}$) 282 (KENYA 220)

MARRIAGE: AGE 15 & ABOVE ARE MOSTLY MARRIED
HOUSEHOLD SIZE: 4-7; 16% HAD 10 OR MORE PERSONS; 43% HAD 6 OR MORE
LAND: ALMOST EVERYONE HAS LAND
OF 35 PREGNANT WOMEN, 61% HAD ATTENDED AN ANTE-NATAL CLINIC

BREASTFEEDING:	% BREASTFEEDING
0-18 mos.	81
19-36 mos.	15

AVER. AGE TO STOP BREASTFEEDING - 15 MOS.
AVER. AGE TO START OTHER FOODS - 4 MOS.
WATER SOURCE:
KASAFARI - 64% OBTAIN FROM STREAM OR RIVER
25% FROM TAP
KANYUAMBORA* 44% FROM STREAM OR RIVER
42% FROM UNPROTECTED SPRINGS
KATHANJURI - 72% FROM TAP (TREATED)
LATRINES:
KASAFARI - 73% HAD NONE
KANYUAM.* 65% HAD LATRINE
KATHANJ. - 94% HAD LATRINE

HOUSING:
KATHANJURI - HOUSING BETTER W/CEMENT FLOORS, TIN OR TILE ROOFS
ALMOST 1/3 OF HOUSEHOLDS HAD NO WINDOWS (VENTILATION NOT AS IMPORTANT AS SECURITY); AVE. 3-4 PERSONS/ROOM

INFORMATION FROM COMMUNITY DIAGNOSIS PAPERS (CONT)

KARURUMO GROUP (CONT)

FELT NEEDS:

FAMILY PROBLEMS: 1. LACK OF MONEY (2) LACK OF FOOD (15% OF ADULTS RESPONSE) 3. LACK OF WATER, CLOTHING, TRANSPORT & GOOD HOUSING 4. HEALTH (15% OF ADULTS RESPONSE)

FAMILY SOLUTIONS: 1. CASUAL LABOR 2. EMPLOYMENT 3. HOSPITAL TREATMENT 4. BUSINESS 5. NOTHING 6. OTHER - FARMING, TANKS FOR RAINWATER, HARAMBEE, HUSBAND'S SALARY

COMMUNITY PROBLEMS: 1 LACK OF ROADS (21% OF ADULTS RESPONSE, 27% OF TEENS RESPONSE) 2. LACK OF WATER 3. ILLITERACY 4 UNMARRIED MOTHERS 5. OTHER - LACK OF MONEY, WORKERS, FOOD, CLOTHING 6. NONE (17% OF ADULTS RESPONSE, 18% OF TEENS)

COMMUNITY SOLUTIONS: 1. IMPROVED FARMING 2. HARAMBEE 3. NOTHING (55%) 4 OTHER - INDIVIDUAL & CHURCH MEMBERS

SOC-ECON.

MAJOR INCOME SOURCE -	SALARY	CASH CROP	BUSNS	SUBSIST. FARM.	OTHER
KATHANJURE	13%	47%	4%	25%	10%
KANYUAMBORA*	20%	15%	10%	46%	8%
KASAFARI	12%	26%	5%	43%	13%

MAJOR EXPENDITURE -	SCHOOL FEES	FOOD	CLOTHING	OTHER
KATHANJURE	31%	24%	35%	10%
KANYUAMBORA*	21%	31%	26%	22%
KASAFARI	21%	25%	32%	21%

* KANYUAMBORA IS OUTSIDE THE PROPOSED STUDY AREA TO THE EAST OF KARURUMO AND KASAFARI IN NGUTU

PROF. C. NEUMANN

NUTRITION CRSP-KENYA 15/4/82

PROGRESS REPORT (BASED ON GANT CHART) [illegible]
APRIL 12, 1982)

ACTIVITY	STATUS
A. Administrative:	
1. Official Approval letters	Pending
2. U. of N/USAID contract	Pending
3. Transfer of funds U of N	Pending; favorable outcome of 1. & 2. above
B. Field Site Selection:	Completed
C. Survey:	
1. Form Design	Ready for field testing
D. Housing/Offices Kabu:	Pending
E. Finance:	
1. Project account	Pending
2. Personnel accounts	Completed
F. Transport:	
1. Renting of vehicles	Ongoing
2. Purchase of used vehicle	Awaiting waiver
3. " " new " "	[illegible]
G. Field work	In preparation
H. Data Management	Ongoing.

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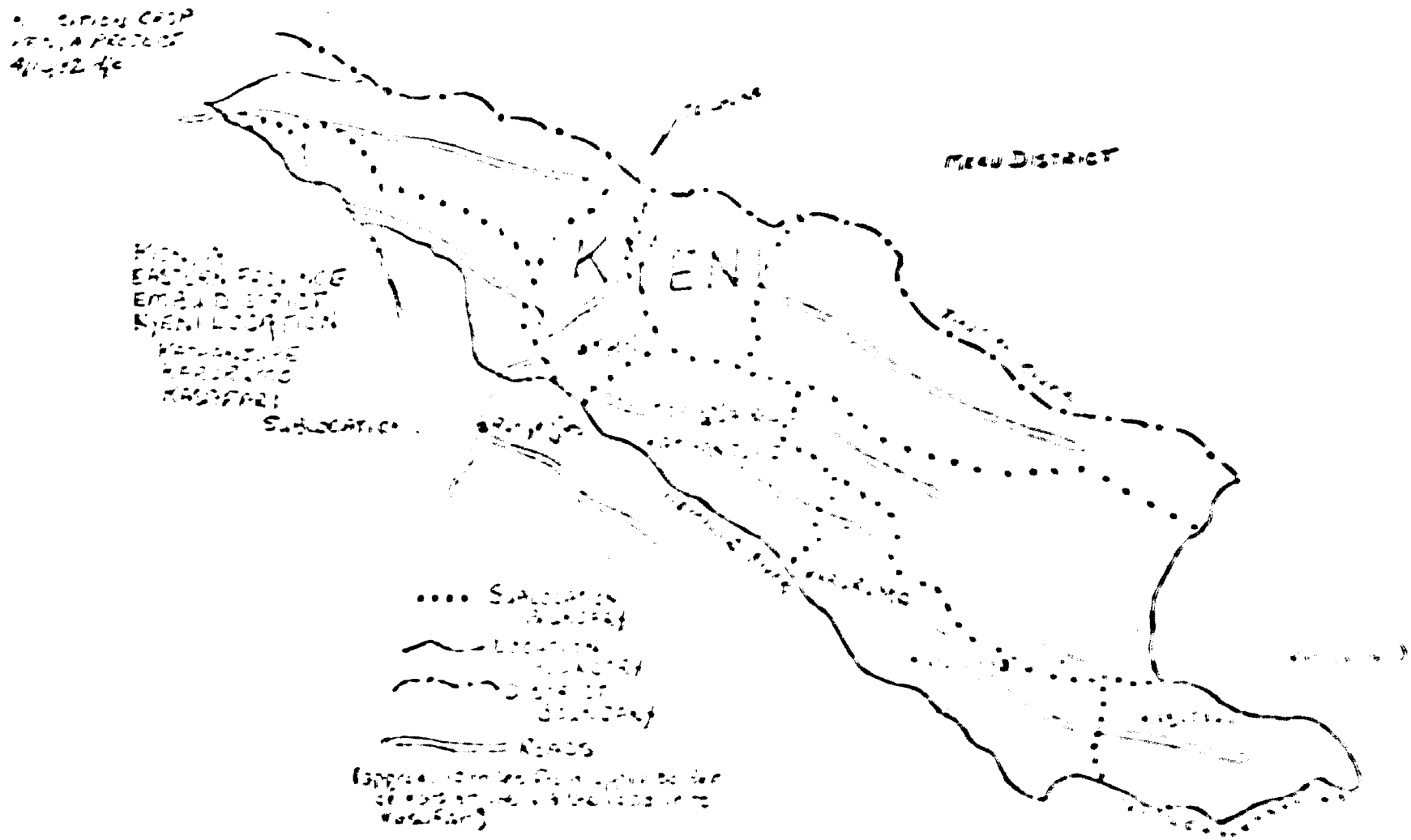

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NUTRITION CRSP - KENYA PROJECT UNIV. OF NAIROBI - MEDICAL SCHOOL
DEPT. COMMUNITY HEALTH
UN - CAL.

PRELIMINARY SURVEY
1 of 3
ENUMERATOR'S NAME
SUPERVISOR'S NAME

HOUSEHOLD CENSUS

DATE
DAY MO YR

HOUSEHOLD I.D. NO. RESPONDANT'S NAME

RESPONDANT'S I.D. NO.

	NAME	I.D. Nr (4 spaces approx.)	AGE (years)	CONFIRMED BY RECORDS Yes - No	SEX	RELATION TO HEAD 1. HEAD 2. WIFE 3. SON 4. DAUGHTER 5. PARENT 6. GRAND PARENT 7. GRANDCHILD etc.	LAST SCHOOL ATTENDED 1. PRIMARY 2. SECONDARY 3. COLL. 4. NO SCHOOL 5. OTHER	MARITAL STATUS 1. SINGLE 2. MARRIED 3. DIVORCED etc. 6. WIDOWED 7. OTHER	PLACE OF BIRTH 1. IN SUBLOCATION 2. OUTSIDE SUBLOCAT.	IF BORN IN SUBLOCATION - HAVE YOU ALWAYS LIVED THERE?	IF NO - HOW LONG RESIDENT IN SUBLOCATION
1.										Yes 1 NO 2	(years)
2.											
3.											

PRELIMINARY SURVEY
PAGE 2 OF 3
ENUMERATOR NAME

HOUSEHOLD CENSUS

DATE | HOUSEHOLD ID | RESPONDENT'S NAME | RESPONDENT'S I.D. NO.

	HAVE YOU SPENT TIME OUTSIDE THIS SUBLOCATION WITHIN THE LAST YEAR 1. YES 2. NO.	IF YES, LENGTH OF STAY OUTSIDE SUBLOCATION 1. LESS THAN 3 MOS. 2. 3-6 MOS. 3. MORE THAN 6 MOS	RELIGION 1. CHRISTIAN 2. ROMAN CATHOLIC 3. MUSLIM 4. TRADITIONAL 5. OTHER	LANGUAGES SPOKEN 1. ENGLISH 2. SWAHILI 3. ENGLISH 4. OTHER	TRIBE	CLAN	MARITAL STATUS	HOUSEHOLD MORBIDITY TO BE FILLED OUT ON DAY 1 STOP	(Tentative list.) FEVER	DIARRHEA	VOMITING	DIARRHEA & VOM	CHD PROBLEM	COUGH	EYE PROBLEM	SKIN PROBLEMS	RASHES	STOMACH PAIN	HEADACHE	OTHER
1.	☐	☐	☐		☐	☐	☐													

STOP STOP STOP

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REGISTRATION AREA
DEPARTMENT OF ENTOMOLOGY, ICMR

PRELIMINARY SURVEY
PAGE 3 of 3
ENUMERATOR'S NAME

HOUSEHOLD CENSUS

DATE.

HOUSEHOLD NO

RESPONDANT'S NAME

RESPONDANT'S ID NO :

HOUSEHOLD MORTALITY

HAS ANYONE IN YOUR HOUSEHOLD DIED IN THE PAST YEAR?

1. YES
2. NO

IF YES WHO DIED?

NAME	AGE AT DEATH	SEX 1. MALE 2. FEM.	AGE	CAUSE OF DEATH 1. ILLNESS 2. ACCIDENT 3. CHILDBIRTH 4. OTHER 5. DON'T KNOW

COMMENTS (ON HOUSEHOLD):

(INDIVIDUALS)

PRELIMINARY SURVEY
PAGE 1 OF 1
ENUMERATOR'S NAME

HOUSEHOLD FOOD CONSUMPTION 24-HOUR RECALL

DATE
DAY MONTH YR.

HOUSEHOLD I.D. NO.

RESPONDANT'S NAME

RESPONDANTS' ID. NO.

TIME OF DAY / PERSONS EATING	TYPE OF FOOD OR DISH	INGREDIENTS	AMOUNTS
MORNING			
MID-DAY			
EVENING			

PRELIMINARY SURVEY

ENUMERATOR (NAME) _____

SUPERVISOR (NAME) _____

ANTHROPOMETRY / PHYSICAL EXAM / BLOOD

DATE: DAY | MO | YR

HOUSEHOLD I.D NO.

RESPONDENT'S NAME

RESPONDENT'S I.D NO

NAME	I.D NO	HT OR LENGTH 0.1(cm)	MUAC (cm)	WT (kg)	PHYSICAL EXAM (YES=1 NO=2) SKIN	EYE	EAR	GOITER	SPLEEN	EDEMA	etc.	LIVER	BLOOD Hgb (gm/dl)	SMEAR RESULTS 2 digits

COMMENTS

PAGE 1 OF 11

ENUMERATOR'S NAME

SUPERVISOR'S NAME

HOUSEHOLD: REPRODUCTION

DATE DAY MO YR

HOUSEHOLD I.D. NO

RESPONDANT'S NAME

RESPONDANT'S I.D. NO

LIST THE WOMEN IN THE HOUSEHOLD WHO ARE BETWEEN 15 AND 49 YRS. OLD AND ASK							
NAME	ID NO.	NUMBER OF BIRTHS LIVE	DEAD	AGE AT FIRST BIRTH	NUMBER OF LIVING CHILDREN MALES	FEMALE	LACTATING NOW YES	NO

PROF. C NEUMAN

HOUSEHOLD FOOD FREQUENCY (7-DAY RECALL BASIS)

ENUMERATOR'S NAME _____

DATE DAY MO YR

HOUSEHOLD ID NO

RESPONDANT'S NAME _____

I.D. NO

FOOD ITEM	AMOUNT USED COMMON MEASURE (STATE)	CODE NO.	KG
MAIZE			
MAIZE FLOUR			
SORGHUM			
MILLET			
MILLET, FINGER			
RICE			
WHEAT FLOUR			
BEAN			
BEAN			
BEAN, LIMA			
BEAN, MUNG			
PEA			
PEA, COW			
PEA, PIGEON			
POTATO, ENGLISH			
POTATO SWEET			
CASSAVA			
YAM			
TARO/DASHEEN			
LEAF, POTATO			
LEAF, BEAN			
LEAF, CASSAVA			
ORANGE			

HOUSEHOLD FOOD FREQUENCY
(7-DAY RECALL BASIS)

DATE DA MO YR

HOUSEHOLD ID NO

RESPONDANTS NAME

ID No.

FOOD ITEM	AMOUNT USED (COMMON MEASURE (STATE))	CODE	KG.
KALE			
TOMATO			
[illegible]			
ONION			
CARROT			
MANGO			
SWEET POTATO			
MILK			
MEAT			
EGGS			
GREEN BANANA			
FAT			
GHEE			
SUGAR			
HONEY			
SUGARCANE			
BREAD			
SALT			
[illegible]			
SODIUM BICARBONATE			
OTHER			

UNIVERSITY OF CALIFORNIA, BERKELEY

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Institute of Human Development

1203 Edward Chace Tolman Hall
Berkeley, California 94720

June 3, 1982

To Whom It May Concern:

Julius Meme, M.D., participated in a three-day workshop, May 26-28, 1982, on the administration of the Bayley Scales of Infant Development. The purpose of the workshop was to clarify and review methods of administering and scoring these infant tests.

The workshop consisted of lectures and demonstrations by the staff of the Institute of Human Development. Each participant administered the Bayley Scales to an infant while under the observation of the staff. All tests were discussed in detail by the group taking part in the workshop.

It should be noted that participation in the workshop does not imply certification as an administrator of the Bayley Scales of Infant Development.

Marjorie P. Honzik

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48

CONTENTS

Report	Chairperson
1. TAG, Food Intake	Doris H. Calloway
2. TAG, Nutritional Status	Adolpho Chavez
3. TAG, Disease	Charlotte Neumann
4. TAG, Reproductive Function	Janet King
5. TAG, Activity	Lindsay H. Allen
6. TAG, Cognition	Theodore D. Wachs
7. TAG, Social Performance	Norge W. Jerome

Additional Reports

A. Household Food Supply/Individual Food Intake Data-Gathering Instrument

B. Field Manual for Anthropometry (revised Phase I)

Report of the Technical Advisory Committee on Nutritional Status

Members: A. Chavez (Chairman)
G. Harrison
C. Neumann

INTRODUCTION

The central question to be addressed by the CRSP is "Under conditions of mild-to-moderate undernutrition, what relationships exist between food intake and various functional outcomes?" Nutritional status can be conceptualized as important in two ways:

1) nutritional status is part of the context within which we look for relationships between food intake and function

2) nutritional status may function as a mediating variable through which food intake and function may be related. Nutritional status thus must be quantified, and measured repeatedly over time, in the same individuals on whom other measures are taken.

The central focus of the research design is on energy intake; therefore, nutritional status measures are also focused on energy status. However, since deficiencies of other nutrients may affect the relationships of interest, provision must be made to control for these when they exist. These deficiencies may take either of two forms:

1) Isolated cases of clearcut nutrient deficiency of a type not prevalent in the community. There will, for the purposes of this study, be identified clinically. These individuals should be treated or immediately referred for treatment, and their households should be excluded from the study.

2) Micronutrient deficiencies which are common in the community. The most likely deficiency is iron, although there may be others in particular projects. Severe deficiencies should be treated (e.g. Hb < 8 am/dl), milder deficiencies should be measured and followed, so that potential inter-relationships with other variables may be elucidated. The severity

and existence of such deficiencies may be useful as a risk factor for energy undernutrition.

During the course of the study, any child who exhibits the following combination of measures of undernutrition should be immediately treated or referred for treatment. The family need not be eliminated from the study, but the intervention should be documented.

Criteria for treatment (any of the following):

1) edema or severe wastage or
2) failure to increase weight plus anorexia and asthenia or
3) 35% less weight than reference tables for age or
4) 20% less weight for height

Other conditions requiring immediate treatment will be listed under "desire section" and reproduction study.

RESEARCH QUESTIONS

1) How is mild-to-moderate undernutrition (MMN) best diagnosed?
2) Is MMN (or adequate nutrition, where MMN is prevalent) related primarily to food intake?
3) If there are relationships between food intake and variety of functional outcomes, which of these relationships are mediated by nutritional status? Which are mediated by energy status versus co-occurring deficiencies of other nutrients? Which due to disease - especially infection?
4) Where MMN is prevalent, what factors are associated with adequate nutritional status? Are these same factors associated with good functional performance?

TYPES OF DATA NEEDED

Nutritional status measures will include anthropometric, clinical and biochemical measures. Since energy status is of primary interest, anthropometric measures will form the most extensive longitudinal data base on

Table I

Relative Importance of Types of Data by Age

Age Group	Data Type: Clinical	Anthropometric	Biochemical
< 1 year	+	+++	+
1-4 years	+++	+++	+
5-10 years	+	++	++
11-16 years	+	+++	+
Adults	0	+	+++
Pregnant & Lactating women	0	++	++

each subject. However, the relative utility of the three types of data vary with age in terms of their sensitivity to mild-to-moderate status of undernutrition. Table 1 depicts the relative importance of these relationships as we see them.

Nutritional status measurements should meet the following criteria.

1) They should be sensitive to mild-to-moderate undernutrition (MMN) of energy or of other nutrients of importance.

2) They should be sufficiently noninvasive to be repeated in a longitudinal fashion.

3) Nutritional status measures should be made on the same individuals as food intake and functional measures. They can, however, be made on a larger number of individuals in order to facilitate sampling.

SPECIFIC MEASURES TO BE MADE, BY WHOM, HOW OFTEN

A. Clinical

Dr. Chavez' group is working currently on a rapid computerized scoring system utilizing combinations of 18 clinical signs of malnutrition. It will be completed by about June 1 and sent to other CRSP projects for evaluation prior to the next SCB meeting. This or a similar scoring system could be used in the field for clinical evaluation. These examinations can be done relatively infrequently (initially and 1x/year after that). One physician from each project should be responsible. These three individuals should spend some time together (? in Egypt ?) in order to standardize their observations.

B. Anthropometry

Core measurements and periodicity are shown in Table 2. Timing may be altered somewhat to coincide with measures recommended by other TAG's what appears here is considered minimal.

The field staff responsible for measuring will vary somewhat from project to project. However, staff, a team (a "measurer" and a "partner")

is required.

Within- and between-project standardization of anthropometric measurements is of critical importance. We recommend the following procedures:

1) Development and use of a detailed field training manual with pictures and training exercises. The Arizona group has developed a draft of such a manual for the core Phase I measurements, and Dr. Zerfas of UCLA has another draft of such a manual in the field with him. These can serve as the basis for further work.

2) Identification of an "expert" for the CRSP and one for each project to facilitate repeated standardization of technique.

3) Use of similar equipment when possible

4) Adoption of quality control techniques including routine performance tests on field staff and routine analysis and sharing of data on inter- and intra-observer replicability of measurements.

C. Biochemical

Biochemical measures of nutritional status should be planned so as to minimize blood sampling. At present there are no highly useful biochemical measures of energy status, although individual projects may want to explore some promising ones such as membrane lipids and/or glycosylated proteins. At present, then, biochemical measures should be confined to those necessary to identify and quantitate micronutrient deficiencies which are prevalent in the study communities. At this time, we recommend only measures of iron status; as more information becomes available from the field sites it may be desirable to add other core measures. Individual projects should include measures relevant to their communities. Baseline data on prevalence of micronutrient deficiencies should be obtained from subjects other than the longitudinal sample, but similar to it.

TABLE 2

Anthropometric Measurements

Age Group	Timing	Measurements
newborn	3-7 days after birth (as close as possible to 3 days)	weight length head circumference chest circumference mid-arm circumference iliac crest to heel length +Dubowitz score
0-24 months	every 2 months ± 1 week	length, weight mid-arm circumference skinfolds (triceps, biceps, subscapular, supra-iliac)

Subroutine on sick children to remeasure at 1-week intervals until well

Over 24 months to 18 years	Every 3 months (Based on local seasonal changes)	height weight arm circumference skinfolds
adults except pregnant and postpartum women	every 3 months as above	height length (initially only) weight arm circumference skinfolds
pregnant women	as soon as pregnancy is identified and monthly thereafter	weight arm circumference skinfolds
postpartum women	every 2 months when baby is measured (whether lactating or not) until 24 months or onset of next pregnancy	weight arm circumference skinfolds

Iron measures should include hemoglobin, hematocrit, and ferritin as a minimum. These require only a finger prick or heel prick. Ferritin assays can be done using the same capillary tube as the Hct. The TAG has information on two methods, and will consult with Drs. Finch and Dallman before making a recommendation. These measures can be done in local laboratories, but a quality control laboratory at one of the US institutions should be designated and should assay duplicate samples on a regular basis for all projects.

INSTRUMENTS

The recommendation of the SCB of October 1981 apply (CDC-type measuring boards, portable beam balances, Lange calipers, Zerfas tapes) with the following additions:

1) We recommend that each project purchase at least one electronic scale suitable for breast-milk studies (infant weighing) and for standardizing other scales.

2) Beam balances are proving unworkable in Kenya. They are resorting to Salter scales with tripod for infants and bathroom spring scales, regularly checked, for adults for reasons of portability.

3) Strong consideration should be given to purchase and use of an Apple-type small computer for each project. Rapid analysis of nutritional status data is essential, and sharing of these data on floppy discs is convenient. Entry and editing of anthropometric data in the field is desirable, since errors are more easily identified and corrected close to the site and time of data collection.

WHO IS RESPONSIBLE

It is important that a physician be responsible for the clinical diagnosis aspects of assessment and directly in charge of the collection of clinical data. However, the methodology to be used must be simple and very routine in the form of a sequence of examination that only requires

very well standardized personnel. Therefore the field work could be done by good and responsible auxiliary personnel. For clinical and anthropometric examination it is required to base the examination on detailed manuals with photographs to provide for quality control of instruments, systems and procedures. For biochemical analysis a local laboratory is needed with specialized personnel and quality control of results using standard samples.

CODING OF INFORMATION

It is important at least to precode all nutritional status information in the field, not only to simplify movements of information but to check the field work.

There exists the possibility of complete coding in the field using microcomputers. This will reduce expenses in copying, mailing, etc. Some logistic problems remain especially related to handling such large volumes of information; the time taken in the field for coding; and translating microcomputer systems and languages (disquettes and Basic) to the definitive system (records or tapes and Fortran).

DATA COLLECTION AND ANALYSIS

It is very important to use similar questionnaires, compare data with the same reference tables and process them in computers with the same programs.

It is recommended to use the WHO standard of weight and length to interpret data on children, and the same formulas in the several projects to predict body composition from arm perimeter and skinfolds.

There also have to be defined the method and equipment for laboratory analyses.

NUMBER OF SUBJECTS

Clinical and anthropometric measures can be done in higher numbers than other measures. They should be used in the preliminary survey for a

"nutritional census" of the area to classify families for sampling, replacements, etc., and can be repeated as necessary for the project.

Revised by Dr. Doris Calloway
6/9/82

REPORT OF THE TAG ON FOOD INTAKE

NEW ORLEANS. APRIL 20-21, 1982

TAG MEMBERS: Doris H. Calloway, Chair
Gretel H. Pelto, Rapporteur
Hekmat Aly
Norge W. Jerome
George Beaton

(with input from A. Chavez and A. Mata
on April 20)

THE CHARGE TO THE TAG

The Food Intake TAG was concerned with two main topics:

1. Methodology for collecting dietary data
2. Management and analysis of dietary data across projects

Since food intake, or more specifically energy intake, is the primary independent variable in the CRSP on Intake and Function, it is imperative that considerable research effort be devoted to ensuring intake data that are adequate for both descriptive and hypothesis-testing purposes. The discussion that follows is based on the recognition that all currently-developed methods are flawed in one or more ways and that the final selection of a data collection protocol will represent a "best compromise" among the competing demands of precision, logistic feasibility and economic constraints. Once collected, dietary intake data can be handled in a number of ways, but cross-project comparability requires agreement about the form in which intake data will be stored in the central program data bank, as well as quality control of the data base that is used to assign nutrient values.

FOOD INTAKE MEASUREMENT

Among the major issues addressed by the group are:

1. What is known about intra-individual variability in food intake generally and in the three program sites?
2. What is known about eating patterns in the three sites, including features such as amount of consumption away from home, style of serving, and eating utensils?
3. Is it necessary to have both household-level and individual-level intake data in order to answer the research questions that are central to the project?

4. Will proposed schedules of the collecting dietary data cover seasonal variations in intake?
5. What alternative methods of food intake measurement are currently under consideration for use in the project? What are their strengths and weaknesses? What is known about their feasibility in the specific field sites?
6. What are the personnel requirements of alternative methods of data collection?
7. What research activities should be undertaken in Phase I to improve data quality and to assist in final selection of the components of intake measurement?

INTRA-INDIVIDUAL VARIABILITY

It is now well-recognized that most individuals, except under very severe environmental or health constraints, exhibit wide day-to-day variations in quantity and type of food intake, with concomitant wide variation in nutrient intake (Cf. Beaton, 1979). As a result a single one-day record is an extremely poor measure of "usual" intake. To further complicate the problem of obtaining an adequate record, there are also social patterns of daily, weekly, and calendric cycles that effect variation in intake in a patterned fashion that may cross-cut physiologically and idiosyncratic socially-determined daily variation (Cf. Jerome & Pelto, 1981). A review of the literature relevant for the assessment of intra-individual variation suggests that in many situations as many as 6 daily records are required to achieve a reasonable estimate, although as few as 3-one-day records may correlate well with 7-one-day records (Stuff et.al, 1982).

At the TAG meeting Dr. Chavez reported that recent, unpublished data from a study of Mexican women showed a disappointingly high level

of variability, higher than anticipated in view of the relatively low level the researchers found in household-level studies. (Dr. Chavez also reported that preliminary analysis suggests that a 2-day or 48-hour record reduces the variability, perhaps because it "captures" the use of left-overs or because it reflects short cycles of appetite-regulated intake). TAG members did not know of current data on daily intake variability for Egypt or Kenya.

RECOMMENDATION 1:

During Phase 1 it will be useful for country projects to collect data that will permit a reasonable estimate of variability. However, it is anticipated that the results will show multiple records are necessary, and planning for Phase II should proceed with the expectation that several food records per season (or per quarter) will be required.

EATING PATTERNS

The protocol for food intake measurement will also depend on where individuals eat (including the stability of eating arrangement), the ease of observing eating behavior and estimating quantity. Food consumed away from home can present serious problems of measurement, particularly with respect to alcohol, which can be a significant source of energy. The use of a "common pot", as contrasted with individual serving dishes, also presents additional problems for researchers.

The TAG members reviewed available information and noted the following points:

1. In the Mount Kenya site there are several aspects of eating patterns that require special attention:
   a. The eating style involves a common pot, usually of millet or maize porridge from which portions are removed with the the fingers and dipped into a sauce.

b. In polygamous households contained within a single homestead, the husband typically eats in a specific location, to which food is brought by each wife for the same meal. Where co-wives reside in different homesteads, the husband frequently eats part of his meal in the house of one wife and part with another.

c. Temporary out-migration of males is common, with the men returning to be with and eat with their families on week-ends. Others return less frequently.

d. As a result of social organization and work patterns, locations of eating and the degree stability of the commensal unit may be highly variable within the sample.

e. Millet-based and corn-based beer is consumed, mainly though not exclusively by men, and is usually home-brewed, which may lead to considerable variability in nutrient content.

2. In Egypt factors to consider are:

a. The use of a common pot

b. The disruption of typical eating pattern during Ramadan; people fast during the day and early evening eating becomes a private act at which observers would not be welcome.

c. Food consumption outside the home, especially by males in factory settings where food may be purchased rather than brought from home.

3. In the Mexican feild site, the eating pattern includes individual bowls, which are used to serve beans, soup or stew, which is consumed with home-prepared maize tortillas. Among the potentially problematic features are:

a. High inter-household variability in consumption of pulque, a mildly alcoholic beer made from the sap of the century plant.

b. Frequency of attendance at fiestas, during which considerable food may be consumed.

c. Frequent food purchase of "snack foods" because there tends to be little in the way of prepared foods available in the household between meals.

RECOMMENDATION 2:

During Phase 1 all projects should collect more data on eating patterns, with special attention to frequency and location of food consumed away from home and frequency and importance of holiday food consumption. Pretesting should also be done on ease of assessing a "handful" or a "spoonful" in the situations where a common pot is used.

HOUSEHOLD-AND INDIVIDUAL-LEVEL DATA

Since the major hypotheses of the study focus on the linkage between intake and a series of functional parameters, it is clear that individual-level intake data are mandatory. The TAG members discussed whether household level consumption data were also required. Several points were considered before reaching a decision on this point:

1. It is likely that in many (large) households individual intake data will not be available for all household members; hence household consumption cannot be constructed from individual-level data.

2. There is growing interest in the nutrition community on intra-familial food distribution and the Nutrition CRSP could contribute significantly to knowledge in this area if household availability data, as well as individual level intake information were collected.

3. The social performance component of the project will require data on food resources of households-a substantial part of household-level consumption data; that is, fulfilling data requirements for one aspect of the functional outcome studies will produce much of the data required for household level consumption, though less precision may be needed to meet the social performance data requirements.

RECOMMENDATION 3:

Projects should develop a dual-level system of intake data collection-for both individual-level and household level consumption. At a minimum, individual-level data should be collected from the "lead male", "the lead female", a child under two years of age; and a school child. (The latter is necessary to meet the demands of some of the social performance functional indicators). Together with intake data on infants born during the data-gathering phase of the project, intake data on the lead female, lead male and young child are necessary to meet the requirements in other functional areas. In addition to these four categories, other household members may be added as resources permit and recommendations from other TAGs require. It is recognized, of course, that variations in household composition will influence the selection of individuals to be selected for individual-level intake measurement. A decision to focus only on "reproductively-active" households means that a "lead female" will be present in all sample households.

In view of the complexity and variability of social organization within project sites, further ethnographic work will be necessary to specify the "household unit" for the purpose of household-level consumption measurement. This needs to be accomplished during Phase I.

SEASONAL VARIATIONS IN INTAKE

Previous research in all three project areas indicates that there are seasonal variations in food availability, especially in households that are at least partially self-provisioning. Because of the requirements for multiple intake records, due to intra-individual daily variability, a schedule of frequent data collection is necessary.

RECOMMENDATION 4:

A schedule requiring monthly data collection will cover all seasonal variation automatically. If individual variability, based on phase 1 data in one or more sites proves to be lower, suggesting a reduction in the total number of intake records, care must be taken in constructing an intake schedule to "capture" high and low intake periods. Preservation of this feature is particularly critical to the overall research design, in which, for some functional outcome measures, individuals serve as their own controls.

METHODS OF INTAKE MEASUREMENT

1. Individual-level Consumption

There is a growing body of literature on the strengths and weaknesses of alternative intake measurement methods. TAG members recommended rejection of the mostly commonly-used and least precise method-the 24 hour recall in which subjects are asked to recollect foods consumed, portion size and time of consumption retrospectively for a 24-hour period. Also rejected as insufficiently precise for project needs, is a food frequency checklist. While fully-observed weighing and measuring is highly precise, it is also very intrusive and costly. Given the requirement of multiple records, the advisability of this type of measurement is questionable. In some circumstances, e.g., in Egypt during Ramadan, it is clearly not

feasible.

In view of the foregoing, TAG members felt that an amalgam or modification of commonly-used methods would be advisable. Dr. Chavez' method, with some modification, was recommended as a model to follow, subject to field testing during Phase I.

RECOMMENDATION 5:

A record of food intake for two 24-hour periods should be collected from each individual from whom individual-level data are required (see above). To minimize subject fatigue it is probably preferable to collect the 2-days during a single week of the month, integrated with other data collection procedures.

The method recommended for field trial in Phase I involves a combination of short-term recall, observation and weighing. (See protocol attached.) A morning visit by the fieldworker uses recall to obtain non-observed intake prior to the fieldworker's arrival for the two "target" individuals. Observation of food preparation is combined with weighing of ingredients and permits greater accuracy of estimating the composition of mixed dishes. When not required for other observations, the fieldworker leaves the house, returning several hours later to inquire about foods consumed during his/her absence. A visit the following morning is necessary to record evening consumption. When the fieldworker remains in the house for other purposes, direct observation and recording of intake is possible. For infants and small children, mothers or other caretakers will be asked to report on intake.

It is presumed that the fact of frequent fieldworker visits to the house helps to ensure accuracy of short-term recall. For subjects with whom frequent contact during the day isn't possible, alternative methods to improve recall should be developed. Among the suggestions offered by

TAG members are: a) the use of small, highly portable tape recorders; b) the use of visually-aided food record diaries, and c) training a household member to keep food records for other household members.

RECOMMENDATION 6:

The method proposed involves intensive contact with household members. Therefore, serious questions have been raised about its feasibility. It is imperative that substantial field-testing, with repeated measurements, be carried out in order to assess subject tolerance. This testing should not be done with sample families and is preferably carried out in near-by, non-project coummunities.

RECOMMENDATION 7:

In addition to fieldtesting for feasibility, it will also be important during Phase I to establish some measure of validity. Direct observation is the preferred method for this task. It is recommended that at least 10 households be involved in the validation study, with 6 repeat measurements on the lead female, and 4 each for the lead male and child.

2. Household-level Consuption

Members of the TAG, were generally in agreement that food use in the three sites probably shows a weekly cycle. Therefore it would be highly advantageous to cover this cycle in measurement of household level intake (it should be noted that appropriate scheduling of individual food intake collection days will also yield a weekly picture over a three-month period). As with individual level data, the 24-hour recall, food frequency and food diary methods were judged to be too imprecise or impractical for our research purposes. The group recommended field trial of a household inventory method. Technically, the method should be regarded as

yielding data on household food availability rather than intake because the quantitative variable is arrived at through measurement of food on-hand, gathered and purchased during the week minus food given to others (including animals).

RECOMMENDATION 8:

A household-level, one-week, inventory of food availability should be collected from all households in the sample. Although the ideal frequency of this measure could be full integration with individual level data (one week for each month) this poses a significant burden for project households. A one-week inventory for each season is probably a more feasible schedule. (See protocol attached.)

A full inventory of food availability requires information on the following components:

1. food stores at the beginning of the 7-day measurement period.
2. food purchased during the period, including foods purchased, prepared and consumed at home as well as foods purchased and consumed away from home by all household members.
3. foods gathered and acquired through other, non-cash transactions (gifts, consumed in other homes, in festivals)
4. foods from stores given to animals.
5. foods given to guests.
6. food stores at end of week.

Thus the household food availability figure for "total available food energy" (T.F.E.) can be computed as:

[1+2+3] - [4+5+6] = T.F.E.

RECOMMENDATION 9:

Field testing is very important to discover ways to facilitate data collection and improve accuracy of collection for this measurement task.

For example, subjects may be willing to transfer grain stores from a central storage location (large sacks) to a more convenient storage (smaller sacks) to facilitate "before and after weighing."

INTRA-FAMILY FOOD DISTRIBUTION

There is a dearth of information about intra-family, intra-household food distribution in LDC settings. There is recurring and wide need for information on partitioning of food in LDC households and factors that influence/predict pattern of distribution.

It is suggested that important information can be gained within the CRSP, without imposing major data gathering requirements, at the data analysis phase, relating partitioning to for example family structure, socio-economic status, control of income (male-female split of responsibility for income allocation), apparent need in terms of altered situation of individuals (e.g., change in physical activity associated with work cycles, response to illness of a child, change in income/food availability (e.g. seasonal cycles in quasi-longitudinal data, and relative "priority" given to different family members. Note that most of these questions are identical with those that would be asked about absolute intake of individuals. The added dimension is the consideration of partitioning (concurrent examination of individuals).

Specific data needs are intakes of individuals (all members of household or selected individuals; intakes of total household; and composition of household at point of observation including enough information about activities to approximate energy requirement.

Partitioning expressed as percentage of total food would obviously vary with the family size/structure. If energy requirements are estimated (i.e. mean req. for particular class of individual) then one approach would be to express partitioning in relation to "equitable distribution."

$$\text{Individual share (equity base)} = \frac{\text{obs. intake}}{\text{Energy Req.}} \times \frac{\text{Aggreg. requirement}}{\text{Aggreg. intake}}$$

The aspects of partitioning described above can be addressed in multivariate analysis in which the variables are 'controlled' one at a time. The analysis can address the factors affecting the "share" of selected single classes of individuals.

Even more interesting will be longitudinal analysis, (using paired data?) which can be analyzed concurrently with other measures to ask, for example:

When the work requirements change in connection with agricultural cycle, does this influence distribution of "equity shares"? If so, how is this change in equity share reflected in profile of activities? (This, in effect becomes a measure of "coping ability" as well as a measure of consequence of level of food intake--does the pattern vary with level of <u>household</u> intake?) When a child is sick/anorexic, what happens to his/her share of the food? (Again using paired data.) If the family is "short" of food (i.e., there is a felt demand for additional food), one would expect that the unused food would be redistributed; if no/low demand the total family intake would decrease. This might be an interesting cross-check on our interpretation of "adequacy/inadequacy" of intakes in terms of household's perceptions.

<u>RECOMENDATION 10</u>:

Information is needed on all members of household and non-target individuals should be included in the design. Self-recording methods should be tested to reduce personnel demands. (See protocol attached.)

<u>RECOMMENDATION 11</u>:

Relative roles of private vs. public consumption need to be

considered, especially vis-a-vis particular individuals. Private includes snacks to mother or child while cooking, gleaning/gathering away from house, food purchased casually in market, etc., that may be a family mechanism for adjusting intakes without visible changes in public consumption/partitioning.

Since it is difficult to measure private consumption, it may be something that needs to be examined in each country to assess the potential magnitude in that setting, or in each household in some sort of sampling design which is less frequent than regular dietary intakes.

PERSONNEL REQUIREMENTS:

All TAG members agreed that successful execution of an intensive data collection plan requires that fieldworkers establish and maintain excellent rapport with families in the sample. They also agreed that the proposed plan was very costly in personnel time. Therefore personnel for diet intake will probably require a tiered arrangement, in which research aides will live in (or close to) the community, with supervision by a nutritionist to ensure quality control of data collection. It is likely that one aide will be required for each set of 8-12 families. Projects should consider rotating aides after 6 months to avoid systematic bias as a consequence of interviewer effect.

SUMMARY OF PHASE I RESEARCH OPERATIONS FOR FOOD INTAKE

There are a series of research operations during Phase I that are needed to make final decisions about the core protocol now proposed for Phase II intake measurement:

1. Pre-testing of modified, short-term recall with observation for individual-level data on target individuals and self-supporting methods for others.
2. Pre-testing of one-week household inventory.
3. Testing effectiveness of secondary measures, including the

use of tape recorders, self-maintained records and household record keepers.

4. Testing of sufficient duration to provide some indication of the feasibility of the proposed schedules and methods of data collection.
5. Ethnographic research on eating patterns to make a general assessment of the stability or variability of these patterns, types of non-home food consumption, and other cultural features that may affect food intake data collection.
6. Food intake records that will provide some indication of intra-individual variability.

PART II. MANAGEMENT AND ANALYSIS OF DIETARY DATA ACROSS PROJECTS

The TAG members also considered a series of issues concerning the management and analysis of the dietary data to ensure cross-project comparability. These issues were less thoroughly discussed than those pertaining to food intake and need further amplification. The main questions addressed were:

1. Which nutrients should be routinely reported for all subjects (with individual-level food intake records) across all projects?
2. What is the state of food composition tables for foods of the three project sites? Which nutrients should be analyzed regardless of currently available data?
3. In what form should food intake data be stored in the central (cross-project) data bank? Is it preferable to store this information as "foods", "groups of foods" or as nutrients?

Given project goals, the most important information at the individual level is intake of protein, carbohydrate and fat. Beyond that basic minimum presentation of data-as-nutrients may depend on the recommendations

of other TAGS and on the research interests of individual projects.

There is some variation across country projects in the availability of dependable, locally-specific food composition data. Very extensive data are available for Mexico, while representatives from Egypt and Kenya felt more work was probably necessary to achieve an adequate data base, depending on which nutrients were selected for analysis.

RECOMMENDATION 12:

The TAG members recommend the following as the minimum analysis for all foods, using AOAC methods throughout:

1. water
2. ash
3. nitrogen
4. crude fat (ether extract except where AOAC method is different, e.g. milk)
5. carbohydrate (by difference)

And, for staple food items, it would be desirable to measure dietary fiber.

FOOD INFORMATION STORAGE

The members of the TAG did not reach a recommendation on the form of information storage. There was general concensus that storing information centrally as food would provide much greater analytic flexibility (e.g. ratio of animal to vegetable protein sources), and would consitutute an important food intake data base for future (post-CRSP) analysis. At the same time, it should be recognized that storing food intake information from individuals in three sites, with multiple records from each individual, will create a mammoth data bank, with potentially formidable management problems. This issue, clearly, needs further discussion.

ADDITIONAL SUGGESTIONS AND ISSUES

In the course of the meeting, a number of other suggestions or issues were discussed - presented here as "food for thought".

1. If individual-level variations in intake considerably exceeds household-level variation, which member or members of the household "control" or determine availability?
2. Project staff should be alert to the possibilities for developing aids for self-maintained (self-records) and household-maintained food records, including developing some incentives for people to keep records.
3. Consideration should be given to the possibility of regarding ability to maintain records as a measure of social performance.
4. Fieldworkers who are making observations for other purposes should also be alert to recording all food intake.
5. Researchers should consider the selective use of food histories, including "remote" history. Questions concerning perception of past food intake ("Do you remember a time during your [past pregnancy] [your childhood] when you didn't have enough to eat?") may be significant indicators of past conditions even when they cannot be otherwise verified.
6. When setting up the schedule of food intake measurement care must be taken to ensure that the range of variation in intake is represented in each sampling week so that no sample bias intersects with calendric cycles.

Attachment

PROTOCOL FOR FOOD INTAKE PLAN

This protocol is to be tested for feasibility and practicability in Egypt, Kenya, and Mexico. Basically, this food intake method will entail eight consecutive days of interviews, observations, and measures, with interviews providing the bulk of the work. This eight-day period will be repeated once per month in target households except that items starred (*) occur only every 3rd month. The work is delineated below, in chronological order by day.

Day 1

1. Interview the lead female:

   *a) Take the beginning food inventory of all the family's food in store from her.

   b) Obtain her food plan for the week. That is, does she plan to buy more food this week, what, about how much of it. What does she plan to prepare?

   c) Do a health questionnaire which is retrospective for one week. Ask if anyone in the household has been sick in the past week, what was wrong, what the non-food intake (e.g. medicine) was during this period (for disease (x.).

   d) Begin a 24-hour food intake for the lead female, starting with the first intake for Day 1, up to the time of the interview. Record interview time.

   d) Begin a 24-hour food intake for one preschool child, for the same interval as the lead female (first intake of Day 1 to interview time).

2. Observe food preparation techniques for the next meal(s). Record the recipes of food prepared including estimated quantities of ingredients. Obtain as many of them as possible from the lead female, who will be the preparer in most cases. Weigh and measure

ingredients for any food being prepared while interviewer is present.

Day 2

1. Interview the lead female:

   a) Complete the 24-hour intake for the lead female from time of Day 1 interview to last Day 1 intake.

   b) Complete the 24-hour intake for the preschool child in the same manner.

   c) Do a health query from her for the past 24 hours for the household (for diseas fx.) of anyone is ill, begin subroutine (still to be developed).

   * d) List food added to inventory in the past day, listing purchases gifts, gathered food, and bartered foods.

   * d) List food subtracted from inventory, listing gifts, consumption by guests. (Also list non-food items similarly removed for soc-econ fx.?)

2. Observe food preparations for the next meal(s), again obtaining as many weight or estimate quantities wherever possible.

3. Begin a 24-hour food intake on the lead male. The lead female can report on foods she served him and packed for his work lunch. He can report on additional intakes. Start intake from the first Day 2 intake to time of the interview.

4. Begin a 24-hour intake on one school child, from first Day 2 intake to time of interview. The lead female can report on foods she served the child and packed for school consumption. The child can report additional intake.

5. Return in late evening:

   a) Interview the lead male. Complete the Day 2 24-hour intake on him, including any out-of-house intake.

   b) Interview the school child. Complete the 24-hour intake for

Day 2 on the child, obtaining any out-of-house intake also.

c) Distribute 24-hour food intake diary forms to all persons eight years old or older, except the lead male and lead female. Instruct them that they will do their own food intake for day 3, and how to do it.

Day 3

1. Interview the lead female:

   *a) List food added to inventory in the past day.

   *b) List food subtracted from inventory in the past day.

   c) Obtain health query information from her (for diseas fx.)

2. Observe food preparations for the next meals(s), obtaining recipes for foods prepared including estimates of quantities of ingredients; weigh and measure ingredients used while present.

3. Weight and measure subjects as required by nutritional status and reproduction fx.

4. Instruct all persons who received the 24-hour food intake diary forms to give them to the lead female when they are finished recording Day 3 intakes. Check on progress.

Day 4

1. Interview the lead female:

   *a) List food added to inventory in the past day.

   *b) List food subtracted from inventory in the past day.

   c) Obtain health query information from her (for diseas fx.)

   d) Collect all 24-hour food intake diary forms from her, and verify their accuracy and completeness with her and any others present at the time of the visit.

   e) Begin the second 24-hour intake record on the lead female, from time of first Day 4 intake to time of interview.

f) Begin the second 24-hour intake record on the preschool child, from time of first Day 4 intake to time of interview.

2. Observe food preparation for the next meal(s), obtaining the food recipes and recording quantities as before.

Day 5

1. Interview the lead female:

a) Complete the second 24-hour intake on the lead female, from time of last interview to last Day 4 intake.

b) Complete the second 24-hour food intake on the preschool child, from time of last interview to last Day 4 intake.

c) Obtain health query information from her (for disease fx.)

*d) List food added to inventory in the past day.

*d) List food subtracted from inventory in the past day.

2. Observe food preparations for the next meal(s), obtaining the recipes and recording quantities as before.

3. Begin the second 24-hour food intake on the lead male. The lead female can report on foods she served him and packed for his work lunch. He can report on additional intakes. Start intake from the first Day 5 intake to time of the interview.

4. Begin the second 24-hour food intake on the school child, from the first Day 5 intake to the time of the interview. The lead female can report on foods she packed for school consumption or served the child. The child can report additional intakes.

5. Return in late evening:

a) Interview the lead male. Complete the second 24-hour food intake on him, including any out-of-house intake.

b) Interview the school child. Complete the second 24-hour food intake on the child, obtaining any out-of-house intake also.

c) Distribute the second 24-hour food intake diary forms to all persons eight years old and older, except the lead male and lead female. Instruct them they will be taking their own food intake information down, and show them how to do it for Day 6.

Day 6

1. Interview lead female:

   *a) Obtain the list of food added to inventory in the past day.

   *b) Obtain the list of food subtracted from inventory in the past day.

   c) Obtain health query information from her (for disease fx.)

2. Observe food preparations for the next meal(s), obtain recipes, and record quantities as before.

3. Check on progress of 24-hr records.

Day 7

1. Interview the lead female:

   *a) List food added to inventory in the past day.

   *b) List food subtracted from inventory in the past day.

   c) Obtain health query information from her (for disease fx.)

   d) Collect all 24-hour food intake diary forms from her, and verify their accuracy and completeness with her and any others present at the time of the visit.

2. Observe food preparation for the next meal(s), obtain recipes, and record quantities as before.

3. If there is a pregnant lead female, begin the third 24-hour food intake record for Day 7, timed as previously established in doing the other intake records (for reproduction fx.)

4. Monitor and record the specific activities of the pregnant lead female for reproduction fx.)

5. If there is a breast-fed child in the household, begin a 24-hour food intake for Day 7 on the child. If as per reproduction fx.

plan, do pre- and post-feeding weighing of infant; otherwise weigh supplemental foods only.

Day 8

1. Interview lead female:

   *a) Complete food added list for inventory in the past day.

   *b) Complete food subtracted from inventory in the past day.

   *c) Take a final food inventory of all the family's food in store from her.

   d) Complete (if there is a pregnant lead female) the third 24-hour intake on the pregnant lead female for Day 7.

2. Complete the 24-hour food intake on the breast-fed child (if there is one) for Day 7.

DRAFT

Report of the Technical Advisory Group (TAG) on Disease

New Orleans, April 20, 1982

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Members present:

Prof. Nimrod Bwibo, Univ. of Nairobi School of Medicine (Kenya Project)
Dr. Ranjit Chandra, Memorial University School of Medicine (Mexico Project)
Dr. Mata (Field Coordinator, Mexico Project)
Dr. Charlotte Neumann, UCLA School of Public Health/Medicine (Kenya Project)
Chairperson of TAG
Dr. Ronald Watson (Eygpt Project)

The purpose the the TAG on disease was to set forth a core set of measurements and methodologies for the evaluation of the effects of mild moderate energy deficits (marginal malnutrition) on immunologic function and clinical morbidity from prevalent infections and parasitic diseases. It is also understood that disease is an important intervening variable for all all of the dependent and independent variables studied. There needs to be a clear documentation in order to interpret all aspects of the study. This is particularly true for cognitive function, work performance and activity, and food intake.

I. Immune Functions

Cell mediated immunity, humoral immunity and secretory immunity will be examined. There is universal agreement by the three projects and well documented in the literature that cell mediated immune function is most affected by nutritional deficiency, particularly protein and energy malnutrition. Secretory immunity is perhaps less sensitive and humoral immunity is the least sensitive to changes in protein energy nutritional status. The TAG members tried to include tests that were minimally invasive, required relatively small amounts of blood, and selected those tests which could be done in laboratories in each of the host countries.

Cell mediated immunity (CMI)

In selecting specific tests an important preliminary step is to determine which immunizations and which naturally occurring diseases are present in the study population so that tests for T-cell functions can be structured to have greater specificity.

Basically for the core measurements examination of tonsillar size, intradermal skin tests for delayed cutaneous hypersensitivity, total lymphocye counts and percent and number of T-lymphocyte will be relied upon.

Tonsillar size

Grading of size by physical inspection will be done. In protein energy malnutrition it has been observed by several workers that tonsillar size in preschool children is reduced proportionately to the degree of severity of protein energy malnutrition. Tonsillar size can be graded on clinical examination. The grading of tonsillar size is as follows:

0 trace or no tonsillar tissue seen.

1+ tonsils clearly visible but do not extend beyond faucial arch.

2+ tonsils enlarged beyond the arch but not beyond the midpoint between the arch and the uvula.

3+ tonsils extend beyond the midline between the arch and uvula.

Normally tonsillar tissue should be seen in children of all ages. The majority of children ages 2-6 years have between 2+ and 3+ tonsillar tissue visible.

Equipment: flashlight, tongue blades.

2. Cutaneous delayed hypersensitivity: Intradermal skin testing will be carried out with a variety of antigens, depending on immunizations received (BCG, tetanus), plus ubiquitous antigens. The antigens to be considered are tetanus Phyto hemaglutinin (PHA), Streptodornase, Streptokinase (SDSK), Candida, PPD, Shick test (if DPT given).

Method

These antigens will be injected intradermally and 0.5 ml saline control will be used. The skin test will be read within 48-72 hours. A test will be called positive if the induration is greater than 3 ml compared to the control test or $\geq$ 5 mm diameter. The maximum diameter of induration will be measured.

Antigens and Supplies: 1 ml tuberculin syringes and 26 guage needles, alcohol swabs: PHA 2 ugm; SK 100 U-SD25U; PPD 5TU; Monilia; Schick test, tetanus toxoid.

Comments

i. Skin testing is not to be done in acutely ill subjects or in those who have just received measle vaccine within the previous week. However, skin tests may be applied at the exact time that measles immunization is given.

ii. If a child is found not to have received appropriate immunizations for age, skin tests will be done and the child immunized after reading of the tests at 48 to 72 hours. Pregnant women, if unimmunized for tetanus will likewise be immunized.

iii. The number of skin tests may be reduced depending on cooperation of the study population.

3. Total lymphocyte count. This can most easily be done by obtaining total white cell count either by standard white cell count procedures manually or by Coulter counter, if available. A differential count is then done on a Wright stained blood smear and percent lymphocytes enumerated.

Total lymphocye count = white cell count X percent lymphocytes. Lympopenia is 2000 lymphocytes per mm^3 or less.

4. Percent and number of T-lymphocytes (T-cell) - This is determined by the ability of T-cells to form rosettes with sheep erythrocytes (E-rosettes). Blood drawing requirements are 3 ml of whole blood drawn into heparinized tubes. (See appendix 1).

For greater specificity, antigen-coated red cells, e.g., with tetanus or measles can be included.

Lymphocyte separation will have to be carried out in a immunology laboratory at a center. For example, in Mexico City, University of Nairobi, the Naval Laboratory, NAMRU at Cairo. The blood must be kept cool (not frozen) but not stored longer than three hours before lymphocytes are separated. There are methods of freezing samples in the field using liquid nitrogen. These are expensive but worth considering.

5. Optional Tests - (methods not included)

a) An optional test for infants under 2 years of age is Bach's assay for thymic hormone which correlates with percent T-cells. It has been found that thymic hormone is reduced in protein energy malnutrition. Extremely small quantities of serum (less than 0.2 ml) are required. The serum can be frozen immediately at -20°C and kept indefinitely before analysis. These

assays would have to be done in the USA or Canada at this time. The advantage of this assay is that it eliminates the need for separation of lymphocytes and doing tests for T-cell rosette formation and requires very little blood.

b) Lymphocyte stimulation (in vitro) using specific antigens (measles, etc.).

c) Terminal deoxynucleotidyl transferase (TdT) in buffy coat leukocytes (Abbott Co. Kits).

d) Studies of cortical steriod and prostaglandin levels.

Equipment

Refridgerated centrifuge
-70° deep freeze
-20° deep freeze
Incubator (37°)

binocular microscope
bunsen burners - self contained
radioactive waste disposal
scintillator counter (beta)
(if in vitro lymphocyte stimulation is done)

Water bath
Tissue culture hood
roto rack
oven 37°
autoclave

Supply

Fresh sheep erythrocytes.

Humoral Immunity (B-cell function)

In numerous studies, B-cell numbers and functions have been found to be variably or not at all affected even in severe protein energy malnutrition. However, there may be disturbances in immunoglobulin production.

Quantitative immunoglobulins (QIG)

IgA, IgM, IgG, will be measured by single radial immunodiffusion (see Appendix).

IgE will be measured by radioimmunoassay (PRIST).
IgE may be under T-cell control and high levels have been seen in protein energy malnutrition. Also high IgE levels are indicative of allergy and parasitism and would be useful to study. Because of the great expense of the IgE kits - only a subsample will be done.

-Reactive Protein (CRP) - an acute phase reactant is a good indicator of infection, particularly bacterial. This requires 0.2 ml serum using a rapid plate method or radial immunodiffusion.

Complement Components

Complement C_3 and factor B levels are extremely sensitive to protein energy malnutrition. These are easily measured along with the QIG's by single radial immunodiffusion.

Serum Proteins

Transferrin, albumin and pre-albumin are good indices of protein nutrition and will also be measured by single radial immunodiffusion along with C_3, Factor B and QIG.

Secretory Antibody Production

Several studies have documented decreased secretory antibody levels in mild moderate PEM. Tears, saline and breastmilk are all readily available biologic substances and obtained in a noninvasive way. Single radial diffusion or enzyme-linked immunosorbent assay (ELISA) may be used to measure levels. Methods must be strictly standardized.

Tears, Secretory IgA and IgG will be measured. Tears are collected by placing a very small piece of sterile gauze in the eye. This is placed in a sterile test tube. The tears are pressed out and frozen for future analysis.

Saliva, the subject is requested to spit* into a sterile tube containing sodium ozide as a decontaminant of the saliva which is heavily contaminated with bacteria. Secretory IgA and IgG are to be measured.

Breastmilk, To be measured will be secretory IgA and IgG. 30 ml samples will be collected and 2 ml aliquots taken for secretory immunoglobulin measurements. The remainder will be frozen for future optional studies as determined by each project.

Breast Milk Cell Counts. PMN, macrophages (cells per mm^3) will be determined.

Sample Collection. For purposes of immunologic studies it would be best to collect the milk at the beginning, midway, and at the end of the feeding. Also at 72 hours, if possible, it would be ideal to collect colostrum (3 ml are needed). These collections should be coordinated with lactation studies and samples for immunology collected every two months.

*If too young, a pipette is used to obtain the saliva sample.

Optional Breast Milk Studies

1. Samples can be obtained throughout the study and frozen for determinations on a subsample of antibodies to commonly found infections, e.g. Rotovirus, E. Coli, respiratory syncitial viruses, tentanus, etc.

2. Lysozyme levels.

Frequency of Immunologic Studies: All studies for CMI, humoral immunity and and secretory immunoglobulins will be done starting with six month old infants and at six monthly intervals thereafter. These studies will be done on a subsample of 100 normal individuals and 100 with mild moderate malnutrition representing all age groups. Breastmilk sample collections, if permitted, will start at 72 hours of age with 3 ml. of colostrum and then at two monthly intervals synchronized with the breastmilk collection for lactation studies.

Laboratory requirements:

It is assumed that each of the host countries will have basic immunology laboratories. Perhaps the only studies to be done in the U.S. or Canada will be some of the optional studies such as Bach's assay for Thymic hormones.

Personnel requirements

Blood drawing in the field. Physicians, nurses or specially trained staff will be required to draw blood and perform skin tests.

Laboratory work: One laboratory technician with hematological background is needed to do white blood cell counts and differential counts. For T-cell studies and immunoglobulin determinations, a supervising immunologist, 2 senior technicians and a laboratory assistant will be required.

Quality Control

1. Common standards will be used by all collaborating laboratories.
2. Common antisera batches will be used.
3. Samples will be exchanged among the different laboratories of the country projects; e.g., between the host country and the counterpart in the U.S. and all the three country projects and with a reference laboratory in the USA (e.g., of the USA institutions).

Set up laboratories in the Fall of 1982. Test blood and other sample procurement and run the analyses.

Coordination of Immunology studies with other functional areas: Immunologic samples should be drawn with blood samples for nutrient status. Skin testing should be done simultaneously.

Evaluation of tonsillar size should be part of the physical examination.

Although it would be ideal to have study subjects come into a project office or clinic for blood drawing it may have to be done in the homes. This will be determined in the pilot phase.

Data Correlation

Correlation of data is to be done with food intake, nutritional status, morbidity, work capacity. Particular nutrients of interest would be protein, energy status, iron, folic, zinc, pyridoxine.

42

II. Morbidity Data Collection

It is well documented that the severity , duration and number of infections are increased in severe protein energy malnutrition. The above will be examined in subjects with mild moderate food energy deficits compared to morbidity in individuals of normal nutritional intake and status. Also to be considered are accidents and injuries which may have some association with nutritional status and sense of well being.

The most commonly found forms of morbidity globally are:

Respiratory infection: upper and lower and otitis media

Diarrheal disease including vomiting

Eye infection

Skin infection

Stomatitis

Fever

Malaria

Childhood "contagious diseases," particularly measles, pertussis

Intestinal Parasites

The approach, except for parasites and malaria, is to define these entities clearly in locally used terms and descriptions and then to make the diagnoses from recognizable components which will be reported by field staff. By identifying the recognizable signs and symptoms a medically qualified individual can reconstruct the diagnoses from the items identified. These signs and symptoms then become the criteria for diagnosis.

Method

The morbidity data will be collected by recall of standardized signs and symptoms obtained by trained field staff using a structured precoded questionnaire. Also physical inspection on the day of questioning will also aid in the identification of illness. The field staff will be trained to recognize signs and symptoms listed on the pre-coded structured questionnaire. Verification by a nurse or physician will be made of serious or key illnesses (see below). The morbidity questionnaire and physical inspection can be administered and synchronized with the monthly food intake data collection.

Recall

On the day of the home visit the mother or other knowledgeable adult will be asked if anyone in the household is sick or has been sick on the day of the visit and for the preceding 7 days. If the respondent says there is no illness this will be recorded but there will follow a quick systematic probe to be sure that there is really no illness present. For example, a cold or diarrhea may not be considered an illness. If there is or has been illness then indepth probing of selective precoded signs and symptoms for the day of illness and for seven previous days will be asked for.

Subroutine

For each illness, source and type of treatment is documented. This may assist in the diagnosis of a given illness. If the sick individual was seen by a medically qualified person the records could be reviewed.

For individuals with a current febrile illness, revisit of the individual in one week will be carried out for anthropometry (weight) and food intake. Foods and fluids given or withheld because of the illness will be identified.

Operational Definitions of Morbidity

Pilot Studies will be needed to define illness in terms of locally recognizable entities and terms, sign and symptoms. Translations will be from English to the local language and back into English again to check for accuracy of translation.

An example of a checklist of signs and symptoms (to be pre-coded) and from which diagnoses will be made is in the appendix.

Illness Categories and Definitions

General*

Fever - $\geq$ 100° using a disposable skin thermometer or oral thermometer

Record DPT or TAB or other immunizations given within 48 hours.

Edema - swelling of face or extremities.

Skin

Bacterial

Cellulitis - diffuse, warm, erythematous areas

Impetigo - superficial, oozing and crusted lesions

Pyoderma - boils, abcess, deep infections

Fungal

Ringworm - dry round patches

Scabies

Papules around wrists, fingers, body creases, intense itching

*To be measured if reported to be present on day of interview.

45

Viral Exantham

Rash with fever

Other

Insect bites, allergies, etc.

Ulcers - punched out areas

Seborrhea

Other

Eyes

Conjunctivitis diffuse redness and/or eye discharge

Eyelid infection

Stye

Dryness, cloudiness of eye

Respiratory

Upper Respiratory

Common cold - nasal discharge, cough with no respiratory distress, sneezing, little or no fever.

Acute Respiratory Infection Group - hoarseness, noisy crowlike sounds in inspiration, suprasternal retractions (sucking in over supersternal notch).

Tonsillo-pharyngitis - red pharynx ± exudate, fever, enlarged cervical nodes.

Otitis - pain, discharge, usually fever

Lower Respiratory

Cough with breathing difficulty

Wheezing

Pneumonia - usually febrile, rapid respirations > 30 minutes, labored respirations, grunting, breathing with nostrils flaring, retractions (sucking in of ribs)

Gastrointestinal

Diarrhea and/or vomitting

Stools change in usual quantity and consistency*

≥ 3 watery stools/24 hours or blood and mucous mixed in stool.

severe - dehydration present (sunken eyes and fontanelle > 10 stools per 24 hours)

Mouth

Sore or red tongue

Stomatitis - blisters, ulcers on gums, lips, tongue, roof of mouth, inside cheeks,

Communicable Diseases

Measles - fever, cough, red sore eyes, persistenct cough, photophobia, sore mouth, symmetrical confluent rash.

Pertussis - eye hemmorhages, paroxyms of coughing followed by whoops or vomitting, thick sticky mucous

Jaundice - yellow eyes, dark urine, large liver (hepatitis or malaria)

Tuberculosis - persistent, productive cough. plus skin testing time

*Breastfed infant may have loose stools 3-4 times per day.

Accidents

Trauma

Burns

Other (Describe)

Optional Illness Studies

Some projects may wish to study certain diseases in greater detail, e.g., the selection of certain common tracer conditions such as diarrheal disease, due to Rotovirus or acute respiratory infection due to Respiratory Syncitial Virus both of which are readily identifiable.

The relation between energy intake and severity and duration of illness will be analyzed.

Comments

Protocols for morbidity will be constructed as shown in Appendix. Duration of each sign and symptom will be noted by checking off the appropriate day. Change in eating habits, e.g. anorexia, withholding or addition of particular foods, water, other fluids will be recorded. Source and type of medical care and treatment obtained will be recorded.

Illness will be reported as illness episodes per 100 individuals and mean duration by different levels of food intake and nutritional status.

Frequency of measurements

A recall of illness on the day of the visit plus the preceding seven days will be carried out on each household for all children and the lead male and

48

female, once a month. This could possibly be carried by the field workers* who will be in the homes doing quantitative food intake measures as they will be present in the house for 8 days - once a month. This illness recall could be obtained in day one and then the field worker would have the opportunity to monitor illness present over the next seven days.

Physical examination

This will be confined to the nutritional status examination described in TAG or nutritional status - plus additional items for the disease TAG. These items include blood pressure in adults, liver and spleen enlargement in all individuals, tonsillar size in children, plus items in the morbidity check list in appendix. Frequency will be 2 times a year in children under 2 years and in pregnant women. In others, frequency of physical examination will be once/year.

Parasites

Preliminary survey: Identification of most common intestinal parasites will be carried out by examination of stools for ova and parasites or urine for schistosomiasis. The individuals who are infected will be treated. It is expected that hookworm and ascaris will be ubiquitous. This will be done twice a year on a subsample. Initially 50 households will be done, and depending on the findings, the households will receive appropriate medications. Semiquantitative ova counts will be done.

In malarious areas, thick blood smears will be examined for malarial parasites at the times of hemoglobin determinations or other blood drawings.

*This will depend on what else the food intake person will have to observe - e.g., activity - in which case there would be an overload observations.

Quality control - morbidity data

1. Local terminology and disease concepts must be determined by the ethnographic survey. The signs and symptoms and names of diseases must be translated into the local language and retranslated into English to check the accuracy of translation.
2. Field workers - data collection needs to be standardized and the field staff will be rotated periodically to offset interviewer bias. Interview reinterview bi-weekly by supervisory staff plus validation of illness by the nurse or M.D. of serious illness and regular spotchecking of the field worker and by the supervisor will be carried out.

   Serious or key illnesses requiring nurse or M.D. validation are suspected dehydration, pneumonia, tuberculosis, measles, pertussis, kwashiorkor, marasmus, convulsions, meningitis or other life-threatening situations (e.g., hemmorhage, fracture, unconsciousness).

   A techique in the area of diarrheal disease, for example, is to request the mother to save all stools per day on a young child for 2-3 days and then have stools examined daily by a field worker and health personnel and compare findings to mother's description of stools as to normality. This could be done on a subsample.

Weekly meetings to discuss data collection problems plus monthly educational sessions are essential. Feedback to the population about the findings will help in reliability reporting. Specificity and sensitivity testing should be carried out. For example, a check can be made of one worker's results versus the recall obtained by another worker on alternate days. The supervisor can obtain independent measurements for the same time periods. Also it is important to assess the ability of parents and field workers to

identify certain physical signs, as they compare to physical examination by the physician, nurse or clinical officer. The final diagnosis of specific illnesses based on the symptoms and sign elicited will be made by the physician or nurse.

Mortality

If a death is reported the circumstances or terminal event prior to death must be inquired into (e.g., convulsion, etc.). If medical care was sought or if death occurred in a medical facility, the facility should be consulted for further information. The morbidity questionnaire should also be administered for the deceased individual in the hope of identifying the terminal illness.

Training

Concepts of disease, analysis of common diseases prevalent in a given study area, will be discussed. Abundant visual aids will be used. The staff will be shown repeatedly, examples of all signs and symptoms they will need to recognize -- from patients in clinics, hospital wards, households. Training will be on-going with monthly educational meetings. Role playing will be used in training and standardization of interviewing. Initial training should take about one month.

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TABLE I

TESTS OF IMMUNE FUNCTION

AREA	TEST	BIOLOGIC SAMPLE	GENERAL METHOD	AGE GROUP	FREQUENCY	COMMENT
Cell-mediated immunity (CMI)	Tonsillar Size	None	Physical Inspection Grading of size (See TAG, pg. 2)	6 months through 10 years	Every 6 months	
	Total Lymphocyte counts	Blood (Capillary) 0.2 ml stained blood smear	White cell count (by hemocytometer or Coulter) & lymphocytes by differential count WB ct. x % Lymphs	From 6 months of age	Every 6 months	
	Cutaneous delayed hypersensitivity	None	Intradermal skin tests PPD, Monilia, SK'SD, PHA, tetanus? Shick?	From 6 months of age	Every 6 months	The number of tests will be cut down to 3 or 4 depending on acceptabilit of procedure.
	% and no. of T-cells	3 ml. heparinized blood	E-rosette formation with fresh sheep erythrocytes	From 6 months of age	Every 6 months	Antigen-coated RBC will be used to give test more specificity, e.g. measles, tetanus, etc.
CMI	lymphocyte stimulation (optional)	3 ml. heparinized blood	PHA or measles or tetanus specific mitogens	From 6 months of age		
(Optional)	leukocyte T & T (Optional)	0.2 ml (buffy 10 at)	Radioassay	From 6 months of age		Cells can be dept frozen until future time of analysis
	Bach's Assay for thymic hormone (optional)	0.2 ml serum	?	From 6 months of age	Every 6 months	sera can be frozen until future time of analysis

AREA	TEST	BIOLOGIC SAMPLE	GENERAL METHOD	AGE GROUP	FREQUENCY	COMMENT
Humoral Immunity	Quantitative immunoglobulins QIG (IgA,G,M)	Clotted blood 2 ml (serum)	Single radial immunodiffusion	6 months and older	Every 6 months	
	IgE		PRIST (radioimmunoassay)			IgE (Optional)depending on budget.
Secretary Immune System (Optional)	Secretary IgA IgG Cell counts Lysozyme (Optional)	Saliva Tears Breast milk Aliquot from 30 ml sample	Single radial immunodiffusion ELISA technique cell counts for macrophages	6 months and older	Every 6 months	(Optional) Aliquot of breast milk to be frozen for future antibody studies (e.g., E. coli, rotovirus, etc.) RSV, tetanus
C-Reactive protein CRP		Clotted blood 0.1 ml (serum) plasma	Double diffusion in gel plates or (radioimmunoinfusion or latex	6 months and older	Every 6 months	
Serum Proteins	Transferrin pre-albumen albumen	0.5 ml clotted blood (serum)0.1 ml	Single radial immunodiffusion	6 months and older	Every 6 months	
Complement assays	C_3 Factor B	1.0 ml clotted blood (serum)0.3 ml	Single immunodiffusion	6 months and older	Every 6 months	

52 X

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53 X

APPENDIX

LYMPHOCYTE SEPARATION

Materials

Ficoll - Ficoll 400 Pharmacia Fine Chemicals 800 Centennial Avenue Piscataway, New Jersey 08854

Hypaque - Winthrop Laboratories, Division of Sterling Drug, Inc. New York, New York 10016

Ficoll-Hypaque - 10 parts 33.9% Hypaque (keep refrigerated)
24 parts 9% Ficoll (keep refrigerated) Specific gravity (of Ficoll-Hypaque should be between 1.077 and 1.080 g/ml. Sterile filter. Keep refrigerated.

Method

Mix blood from green-top tubes (heparinized) with an equal or larger volume of normal saline.* (To obtain maximum yield of lymphocytes, as when dealing with small amounts of blood, use a 1.4 dilution of blood in saline.) Carefully layer this mixture over a volume of Ficoll-Hypaque equal to approximately half the volume of blood plus saline. Spin for 30 minutes at 300 g (at the interface). Remove thin, cloudy layer (mononuclear cells) along with 1/4" of layer (Ficoll-Hypaque) below the interface. Add a little Hanks and spin for 10 minutes at 450 g. Take off supernatant. Wash pellet with Hanks, spinning for 10 minutes at 200 g. Take off supernatant. Dilute pellet (cells) and count.

For background information see Scand. J. Clin. Lab. Invest. vol 21, Suppl 97, 1968.

*Transfer heparinized blood from tube with #18 needle into a 35 ml syringe change needles.
Then swab saline container with alcohol pre sponges and resume required amount of saline. Avoid getting RBC into saline.

Method: E-Rossette Method for T-cells

For the rosette assay, lymphocytes were separated from the buffy coat of heparinized blood on a ficoll/isopaque gradient. Sheep red blood cells were washed three times in Hanks Buffered Salt solution pH 7.4 and made up to a final suspension of 0.5%. A cell suspension containing 2×10^6 lymphocytes in 0.4 ml of Medium 199 was incubated at 37° C for 10 minutes with an equal volume of 0.5% sheep red blood cells. After centrifugation at 150 G for 3 minutes the supernatant was removed and the cell button held for 20-24 hours at 4° C. The cells were then resuspended in 0.3 ml Hanks Buffered Salt solution on a vertical rotator for 1½ minutes. A small amount was pipetted gently onto a microscope slide and overlayed with a coverslip which was sealed at the edges with Permount (Fisher Scientific Co., Fairlawn, N.J.). The percentage of lymphocytes binding two or more sheep red blood cells was counted. Counts, done on duplicate samples, were of at least 200 lymphocytes each time. A normal Caucasian adult control was used on each occasion.

In-vitro PHA stimulation was performed by a microtechnique on purified lymphocytes using increasing doses of PHA, and measuring DNA incorporation of tritiated thymidine.[1] The results were expressed as the ratio of counts per minute stimulated cells to counts per minute unstimulated.

EXAMPLE (NARANGWAL)
J.H.UNIV.

Month of

	1	2	3	4	5	7	8	9	10	11	12	13	14	15	16	17	18
100 GENERAL No Complaint																	
101. Fever *																	
102. Pallor*																	
103. Oedema																	
200 RESPIRATORY No Complaint																	
201. Nasal Discharge *																	
202. Sore Throat																	
203. Ear Discharge *																	
204. Croup																	
205. Cough *																	
206. Paroxysmal Cough																	
207. Whoop																	
208. Rapid Respiration *																	
209. Flaring of alae nasae																	
210. Retraction of chest walls																	
211. Cyanosis *																	
300. GASTRO INTESTINAL No Complaint																	
301. Abnormal Frequency of stools *																	
302. Abnormal Consistency stools *																	
303. Fullness of Stools																	
304. Blood in stools																	
305. Mucous in stools																	
306. Vomiting																	
307. Anorexia																	
308. Dehydration *																	
309. Parasites *																	
400. EYE No Complaint																	
401. Purulent Discharge *																	
404. Blepharitis																	
405. Follicles																	
406. Other *																	
500 SKIN No Complaint																	
501. Vesicle																	
502. Pustule																	
503. Blister																	
504. Papule																	
505. Furuncle																	
506. Fissure																	
507. Ulcer																	
508. Crust																	
509. Scales																	
510. Excoriations																	
600. MOUTH No Complaint																	
601. Vesicles on cheek, gums or lips, palate or tongue*																	
602. Ulcers on cheek, lips, gums, palate or tongue*																	
603. Sore tongue																	
604. Angular stomatitis *																	
605. Tonsils																	

Notes: * [illegible]

[illegible] [illegible] [illegible] or degree

[illegible] result of mother is [illegible] general

[illegible] observation and recall on probing after observation [illegible]

Submitted by the Reproduction TAG:
Lindsay Allen
Nancy Butte
Avanelle Kirksey
Janet C. King
Cheryl Ritenbaugh
Steve Read

Received 6/10/82

Reproductive Function
(Additional information to follow after decisions are made on the primary measurements)

I. Fertility Assessment

Research Question One: Does variation in food intake alter the length of postpartum amenorrhea in lactating women?

Independent Variable	Dependent Variables
a. Food Intake	a. Onset of menses
	b. Fall in urinary estriol
	c. Birth interval

Confounding Variables

a. Maternal nutritional status at conception, at delivery and during lactation.

height, weight, skinfolds, body circumferences

b. Infant feeding pattern.

frequency, length of feeding

c. Milk Volume Output.

d. Infant supplemental foods.

e. Environmental conditions: maternal illness, infant illness, climate, agricultural work.

Data Needed	When Collected	Resources Needed
1. Food Intake	Biweekly till end of lactation/end of study	Standardized Food Intake Procedure; see Food Intake TAG.
2. Onset of menses	Biweekly questionnaire	Culturally appropriate questions.

Data Needed	When Collected	Resources Needed
3. Urinary estriol levels.	Every 3 months 24 hour collection from the mother during the test-weighing day.	Laboratory to perform urinary estriol assays Urine jugs Ice chest Freezer for storage Dry Ice for shipping
4. Birth Interval All women 18-45 years. Ages of all live-born children.	Initial Interview	Questionnaire with culturally appropriate questions. Well-trained, local interviewer.
5. Maternal Nutritional Status All women 18-45 years Weight, height, skinfolds and circumferences.	Every 3 months till pregnant, then monthly throughout pregnancy and lactation.	See Nutritional Status TAG Report Equipment: Balance Adult height board Skinfold calipers Plastic flexible tapes
6. Infant Feeding Pattern All infants breast-fed fully or partially a. Number of feedings daily b. Length (minutes) of each feeding.	One day biweekly when test weighing done.	Forms for recording data Well-trained home observers Stop-watches
7. Milk Volume Output All lactating women. Weight of infants before and after each feeding	Every 3 months	Infant balance Well-trained home aid

Data Needed	When Collected	Resources Needed
8. Infant intake of supplemental foods. All infants breast-fed fully or partially a. What eaten b. How much c. When	One day biweekly when test weighing done.	Forms for recording data Well-trained home observers
9. Environmental Conditions a. Maternal Illness b. Infant Illness c. Climate: Rainy/Dry season d. Agricultural work Mother: Hours worked in fields. Mother: Number of minutes in heavy activity, i.e. on feet and lifting, scooping, digging, carrying, etc.	Record biweekly when assessing food intake.	Forms with culturally appropriate questions and for tallying heavy activity. Well-trained home interviewer/observer. Watches See Morbidity and Social Performance TAG's.

Research Question Two: Do chronic differences in food intake alter the age of menarche?

Independent Variable

a. Food Intake

Dependent Variables

a. Age of first menstrual period

b. Peak height and weight velocity

Confounding Variables

a. Early Nutrition History: Malnutrition leading to growth retardation early in life; menarche delayed until a critical size achieved; thus age of menarche may be unrelated to current nutritional state.

b. Activity patterns.

c. Body composition
Body fat

Data Needed	When Collected	Resources Needed
1. Food Intake a. All pre-pubertal and pubertal girls years of age. b. All women between 18 and 45 years.	Biweekly	Standardized procedure for weighed/measured intakes or for 24 hour recalls. See Food Intake TAG.
2. Age of first menstrual period. All women between 10 and 45 years.	Initial Interview	Culturally appropriate questions.
3. Related issues a. Age when first married. b. Age when first pregnant.	Initial Interview	Culturally appropriate questions.
4. Peak Height and weight velocity All pre-pubertal and pubertal girls Weight, Height Arm Circumference Skinfolds	Every 3 months.	See Nutritional Assessment TAG. Balance Adult height board Skinfold calipers Plastic, flexible tape.
5. Body Fat Skinfolds, weight	Every 3 months.	Same as above.
6. Early Nutrition History All girls 9-18 years a. Hospitalized before 5 years of age? b. If so, why? c. If hospital records are available, obtain heights and weights at that time.	Initital Interview	Culturally appropriate questions.
7. Activity Pattern or Energy Expenditure	Every 3 months.	See Activity TAG.

II. Pregnancy Assessment

Research Question One: What are the effects on the malnourished woman of the additional nutritional stresses imposed by pregnancy?

Independent Variables

a. Food Intake

b. Stage of pregnancy

Dependent Variables

a. body composition (fat, LBM)

b. weight gain

c. growth (in growing women)

d. activity patterns, energy expenditure

e. RQ, BMR

f. post-prandial thermic effect

g. protein turnover

h. urinary ketones

i. postpartum weight

Confounding Variables

Parity

Age

Length of lactation

Illness, disease

(Nausea), vomiting

Optional Dependent Variables

a. urinary estriol

b. plasma prolactin, HPL, growth hormone, progesterone

Data Needed	When Collected	Resources Needed
1. Food Intake (including preferences, avoidances, vomiting)	3rd/month	
2. Stage of Gestation		
Date of LMP	Monthly questionning about occurrence of menses	Question
Date of "quickening	16-24 weeks of gestation	Question

Data Needed	When Collected	Resources Needed
3. Body Composition & Growth		
Weight	monthly	Scales
Circumferences	monthly	Tape measures
-calf, -thigh, -arm } mid		
Skinfolds	monthly	Calipers
-triceps		
-biceps		
-costal		
-suprailiac		
-subscapular		
Height	monthly	Adult height board
Urinary nitrogen	At 3,6,9 months	Kjeldahls
Urinary creatinine		?
4. Activity/Energy Expend.		
Heart rate monitors on women not in activity study; not calibrated.	2-consecutive days/at 3,6,7,5,9 months	4 heart rate monitors 3 technicians
5. RQ, BMR		
O_2 CO_2 consumption at rest	6, 9 months gestation fasting, after resting 30'	respirometer O_2/CO_2 analyzers (work capacity/equipment)
6. Postprandial thermic effect	substudy only	
postprandial O_2/CO_2 consumption	3, 9 months gestation	work capacity equipment standard meal
7. Protein Turnover		
-Urinary 3 ME' hostidine	6 and 9 months gestation	no meat 3 d. prior 24 hr. urine sample
8. Muscle Mass		
- Urinary creatinine	3,6 and 9 months gestation	24-hour urine sample

Data Needed	When Collected	Resources Needed
9. Use of Fat Stores		
-Urinary ketones	3,6 and 9 month gestation	spot urine sample; fasting a.m.
-Fasting respiratory ratios	6 and 9 month gestation	respirometer O_2 + CO_2 analyzers
10. Metabolic Changes		
Urinary estriol	3,6 and 9 month gestation	24-hour urine sample gamma counter
A possible substudy!		
Plasma prolactin		gamma counter
Plasma HPL		RIA
Plasma growth hormone		
(plasma proesterone)		

Research Question Two: Are there adaptations to energy deficit in the pregnant woman?

Independent Variables

a. Food intake

b. Stage of pregnancy

Dependent Variables

a. Body composition

b. Activity, energy expenditure

c. BMR/RQ

d. Postprandial thermic effect

Data needed, when collected, resources needed as in question one.

Research Question Three: What are the effects of marginal malnutrition during pregnancy on pregnancy outcome?

Independent Variables

a. Food intake

b. Body compostion

c. Weight gain

Dependent Variables

a. Weight of infant at 0-24 hr. and 3-5 d.

b. Height at 1-5 d.

c. Skinfolds; biceps, triceps, subscapular, mid-abdominal; 1-5 d.

d. Head, mid-arm, chest circumference 1-5 d.

e. Hemorrhage; abnormalities in labor and delivery

Resources as per question 1 except Infant scales, Infantometer

Other research questions

Seasonal effects on the above dependent variables

Effect of repeated pregnancies

Effect of duration of lactation

III. Lactation Assessment

Research Question One: What is the effect of malnutrition on the quantity of milk produced?

Independent Variables	Dependent Variables
a. Food Intake	a. Milk volume produced
b. Body composition and anthropometry	

Confounding Variables

Illness - mother and infant

Infant size

Agricultural work

Maternal activity/work

Stage of lactation

Infant supplementary feeding

Maternal age, parity, birth internal

Contraceptive use

Data Needed	When Collected	Resources Needed
Milk volume	4 wks postpartum Every 3 months starting at 3 months postpartum	Test-weighing for a 24-hr period. Standardized electronic balance (K-Tron, Phoenix scale co., Glendale, AZ)

Research Question Two: What is the effect of malnutrition on the quality of milk produced?

Independent and confounding variables - as in question one.

Dependent variables: Total energy and total lipids

Data Needed	When Collected	Resources Needed
Milk sample	At mid-day (between 1000 and 1400 hours), 1 1/2 to 3 hours after previous feeding, all milk from the right breast will be expressed. Done at 4 wks. postpartum and every 3 months starting at 3 months.	Loyd-B-pump. Dry ice chest Amber plastic sample storage containers

Data Needed	When Collected	Resources Needed
Total Energy Content		Carr Bomb calorimeter and by creamatocrit. (hemotocrit centrifuge and reader)
Total lipid content Modified Folch and creamatocit methods		hematocrit centrifuge and reader; drying oven, exhaust hood, balance.

Research Question Three:

What is the effect of malnutrition on the infant feeding pattern?

See question one for independent and confounding variables.

Dependent variables: Length and frequency of infant feeding.

Data Needed	When Collected	Resources Needed
Infant feeding frequency and length of each feeding.	During test-weighing day.	Home observer Forms to record data.

Research Question Four: What are the effects of malnutrition on patterns of body composition changes in the lactating mother and the infant?

Data Needed	When Collected	Resources Needed
Maternal:		
height weight skinfolds -triceps -biceps -costal -suprailiac -subscapular	Monthly	See Nutritional Assessment TAG.
Circumferences -calf -thigh } mid -arm		

Data Needed	When Collected	Resources Needed
Infant:		
height		
weight		
skinfolds - same as maternal		
Circumferences:		
head		
chest		
-calf		
-thigh } mid		
-arm		

Schedule of Reproductive Measures

Measures	Pre pregnancy of Initiation	conception ↓ months 1	2	3	4	5	6	7	8	9	Birth ↓ 1	2	3	4	5	6	7	8	9	10	11	12
												Lactation										
Food Intake																						
Mother	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Infant																						
Test weighing											X		X			X			X			X
Supplementary food and beverage											X		X			X			X			X
Milk composition											X		X			X			X			X
Feeding pattern											X		X			X			X			X
Anthropometry																						
Mother	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Infant																						
Birth measures											X											
Monthly measures											X	X	X	X	X	X	X	X	X	X	X	X
Biochemical:																						
Mother:																						
24 hour urine	X		X			X			X				X			X			X			X
AM fasting urine (ketones)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Plasma (substudy)			X			X			X				X			X			X			X
hormones: HPL (Pg only) GH, Prolactin (Inc only)																						
Activity																						
Mother																						
BMR, R.Q.			X			X			X				X			X			X			X
Activity Pattern (HR Monitors)			X			X		X	X				X			X			X			X
Ethnographic Information																						
Household Evaluation	X																					
Reproductive Indices																						
Menses, Quickening > questioning		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Schedule of Measurements
during one of the months when
all measures will be made.

Week I: Food Assessment Week

DAYS	1	2	3	4	5	6	7
Mother's Food Intake Assess.	x		x		x		
Maternal Milk sampling		x					
AM Blood and urine sampling		x					
Test weighing					x		
Infant feeding pattern					x		
24-hour urine					x		

Week II: Energy Assessment Week

Heart rate		x	x				
BMR			x				
Anthropometry		x					
Postprantial thermic effect			x				

RECEIVED JUN 2 1982

REPORT OF TAG ON ACTIVITY

TAC MEMBERS: Lindsay H. Allen (CT/Mexico) Chair
A. Ismail (Purdue/Egypt)
A. Ferro-Luzzi (UCLA/UCB/Kenya)
E. Messer, Consultant
G. Spurr, Consultant

Submitted May 10, 1982

TABLE OF CONTENTS

Page

RESPONSIBILITY OF THE TAG 1

MAJOR AREAS OF RESEARCH 1

Physical Fitness 1

Physical Activity 1

I. PHYSICAL FITNESS 2

Confounding factors 3
Research questions -- physical fitness 7
Data needed to answer the questions 7
Procedures 8
Subjects 11
Time requirements 12
Quality control and training personnel 13
Personnel 14

II. PHYSICAL ACTIVITY 14

The purposes for which energy is expended 15
Energy balance 15
Research questions -- physical activity 18
Data needed to answer the questions 19
Methods 19
A. Ethnographic phase 19
B. Task observations 21
C. Heart rate monitoring 24
D. Respirometry 26

Subjects 27
Time requirements 27
Personnel 28

EQUIPMENT 29

BUDGET 30

APPENDICES 31

1. Justification for measuring VO_2max 32
2. Assessment of physical fitness 33
3. Health questionnaire 34
4. Suggested methods for extracellular fluid and total body water 36
5. Code sheet for physical fitness 42
6. Suggested time -- motion form 44

REPORT OF THE ACTIVITY TECHNICAL ADVISORY GROUP

RESPONSIBILITY OF THE TAG

The Activity TAG was directed to advise on "both work performance and activity patterns of daily living." This mandate was interpreted as including two major areas of research.

MAJOR AREAS OF RESEARCH

Physical Fitness (work capacity)

Tests of physical fitness permit an appraisal of overall capacity to withstand various levels of physical work. The most useful reflection of this capacity is VO_2max, which is a function of the maximal energy output of aerobic muscle metabolism, and of cardiac output. VO_2 submax will be measured instead of VO_2max in pregnant and lactating women, and the elderly. These measurements will be made in a laboratory.

Physical Activity

"Physical activity" testing will measure activities performed in a field setting. Measurements will include

i) time-motion studies on the male and female heads of household,

ii) daily energy expenditure, derived from coupling data from time-motion studies with the energy cost of each activity. The latter will be derived from both energy costs per task estimated by respirometry, and cumulative heart beats per task coupled to oxygen uptake/heart beat measurements in previously calibrated subjects,

iii) work intensity, measured by heart beats (O_2 uptake)/time for each task,

iv) productivity, or the results obtained in produce as outcome of work,

Physical Activity (cont.)

v) energy expended in specific activites, including obligatory compared to discretionary (leisure) activities,

vi) efficiency of work, measured as time and energy used to perform a task, and

vii) task allocation among members of each household.

The fitness and activity components are related in that fitness to perform work should be reflected in an increased work intensity, duration, productivity and efficiency, and a decreased time spent resting. However, if an individual is malnourished, his/her activity is likely to change in order to adapt to the energy deficit. Little is known about the adaptations which occur in marginal malnutrition, and a major goal of this research will be to identify the ways in which the above physical activity parameters are affected.

I. PHYSICAL FITNESS

VO_2max is markedly reduced in severe malnutrition, but there is relatively little evidence that marginal malnutrition produces measurable effects on this parameter. Productivity in sugar cane cutters has been shown to depend on nutritional status through its influence on VO_2max, height, and body composition. The maximum effort a well-trained individual can sustain for an 8-hour working day is one which uses about 35-40% of VO_2max. Individuals with a lower VO_2max may work with less intensity (at a lower % of VO_2max) or have a decreased endurance time at a given work load. Which, if either, of these situations occurs in marginally malnourished subjects is not known, but will be assessed by comparing fitness and activity data in this research.

It is generally agreed that the best single indicator of physical

fitness is VO_2max. It is also the one most widely used, and thus the one on which most information is available. It has been measured successfully in 5-year-old children. Evidence is attached that negligible risk is involved with this procedure (Appendix 1). In the elderly, there is an increased risk of ventricular fibrillation (about 1 in 3,000). Therefore, for subjects over 50 years of age, and for pregnant women, VO_2submax measurements will replace testing at VO_2max. One drawback to the submaximal approach is that a direct extrapolation from submaximal to maximal heart rates involves some error. The relationship between oxygen uptake (or heart rate) and work load is not linear at higher levels of activity. However, the error involved in this extrapolation will not obscure the significance of the data, and effects of nutritional status on VO_2submax per se can also be analyzed.

There is little evidence to indicate that evaluating flexibility, coordination, strength, skill, etc. are related to nutritional influences. They are largely affected by cognitive and motor skills, and the type of habitual activity. It is not recommended that these tests be included as part of the core measurements of activity.

Confounding Factors

The following is a brief description of selected factors which may confound the interpretation of data obtained during the assessment of both work capacity and activity.

Previous training and habitual activity

Heavy exercise for even half an hour per day can cause a significant improvement in fitness, without a large effect on total daily energy expenditure. Therefore, habitual physical activity is a potentially

confounding factor which must be taken into consideration in this study. Habitual activity is likely to depend heavily on the seasonality of crop production in the three projects. For example, energy deficits may be greatest in the planting season due to a combination of increased activity and food shortage. However, fitness may increase at this time due to the training effect of the increased exercise. In the harvest season, fitness and food intake are likely to increase concomitantly.

Anemia

In chronic anemia, blood volume tends to remain relatively constant, but the amount of circulating hemoglobin (Hb) is reduced. Hemoglobin levels determine the capacity of the blood to transport oxygen. Thus, in anemia there is a substantial decrease in VO_2max. This decrease has been shown to be about 34% if Hb is less than 8g/100 ml, and 24% if Hb is 8-10 g/100 ml. The relationship between Hb concentration and VO_2max approximates linearity. The data are conflicting regarding the Hb level at which VO_2max plateaus, but it appears to be at 14 g/100 ml or even higher.

The Hb level at which anemia becomes functionally limiting depends on i) the intensity of activity, and ii) the degree of physiological adaptation to anemia (increased circulation through energy-demanding tissues and an increased extraction of oxygen from hemoglobin). At low activity levels (4-8 kcal/min, not usually exceeded in domestic duties) anemia will have relatively little effect, but at high activity levels, the effect will be pronounced.

It is therefore essential that Hb is measured in each individual tested for VO_2max or $VO_2submax$, and desirable that it is measured in all individuals in the energy expenditure studies.

Smoking

Cigarette smoking causes an acute elevation in heart rate and oxygen consumption. Smoking should be prohibited for at least one hour prior to measuring physical fitness. In addition, a consequence of chronic smoking is to decrease the capacity of pulmonary tissue to extract oxygen, and to decrease VO_2max and VO_2submax. Habitual cigarette consumption should be recorded.

Altitude and Climate

Individuals who live at high altitudes have an increased concentration of circulating red blood cells, and higher Hb and hematocrit values. Their cardiovascular endurance, VO_2max and VO_2submax values are higher than when working at sea level. These beneficial effects of altitude are more pronounced at altitudes greater than 2,300 meters.

The Mexico project will be conducted at an altitude of 2,600 meters, the Kenyan project at 1,000 meters and the Egyptian project closer to sea level. Climatic differences may have a marked effect on the intensity and duration of physical work, although a relatively constant microclimate is obtained by appropriate clothing and housing. Ambient temperatures and humidity will be different in the three projects, although fitness measurements will be made in controlled laboratory environments. These differences may preclude pooling of data from the three sites, but some statistical control of these variables will be possible. Nevertheless, it is important to measure the effect of malnutrition on work capacity and performance in different environments.

Race and Sex

Within each of the three projects, racial homogeneity is a criterion for site selection. Inevitably, the races will be different among sites.

Variations in race and sex should not influence measurements such as VO_2max, if these are corrected for anthropometric and differences and body composition. Careful records of race, body size and composition must be maintained.

Alcohol

There is no consistent effect of alcohol on work capacity, but in large doses, fitness is impaired. While few data are available, it appears that energy wastage occurs as a result of alcohol consumption (due to stimulation of hepatic microsomal enzymes) and that BMR is increased by 20% in alcoholics. Although not well-documented, alcohol consumption can be expected to affect the duration, efficiency and intensity of activity, and even the types of activities performed (e.g., sleep vs. work).

The possibility of excluding households which are heavy consumers of alcohol should be discussed by the SCB and each of the TAGS. It is likely that chronic, low consumption of alcohol will occur in many of the Mexican and Kenyan subjects. Records of habitual intake should be recorded when possible, consumption prior to VO_2max and $VO_2submax$ measurements should be prohibited, and intakes during observation of activity profiles must be recorded.

Drugs

Amphetamines, dexedrine and Isophan increase cardiac output, cause vasoconstriction, and increase blood pressure. Habitual use of marijuana and hashish can affect exercise testing, and should be noted in subjects records when possible.

Disease

Any subject with cardiac, respiratory and musculo-skeletal disease or who has other infirmities should be rejected for exercise testing.

These diseases pose a danger while working on the treadmill and may additionally affect activity profiles. Mentally retarded invidivuals do not make good candidates for exercise testing.

Caffeine

About 500 mg caffeine seems to increase endurance in prolonged exercise or work. Caffeine does not affect $\dot{V}O_2max$.

Research Questions -- Physical Fitness

1. Does marginal malnutrition decrease $\dot{V}O_2max$? $\dot{V}O_2submax$? Fitness score?
2. At what age are these effects seen?
3. At what age are they most pronounced?
4. Are the effects similar in males and females?
5. How do pregnancy and lactation interact with the effects of malnutrition on $\dot{V}O_2submax$?
6. How do the effects of early undernutrition (assessed by low stature and head circumference) affect fitness of the adult?
7. Is present nutritional status (weight/height, limb circumferences, skinfold thicknesses, body composition) more important in determing VO_2max and $VO_2submax$ than early nutritional history?
8. What is the relationship between fitness and the various parameters measured in the studies of physical activity?

Data Needed to Answer the Questions

Resting heart rate

Maximum heart rate

Recovery heart rate (20 minutes after exercise)

Resting systolic blood pressure

Resting diastolic blood pressure

Resting pulse pressure

VO_2max/kg/min

VO_2submax/kg/min

Body composition

Physical fitness score (calcualted from the above data, see Appendix 2)

Additional data obtained during fitness testing;

Resting metabolic rate

RQ

Procedures

i) Questionnaire to assess

General health, medications (Appendix 3)

Habitual consumption of alcohol, cigarettes, other drugs (Appendix 3)

Habitual activity (to be developed at each site; includes data on occupation, sports, transportation, leisure activities, rest and sleep)

ii) General health and physical examination, including test for parasites

iii) Anthropometric measurements

Age, sex, physiological state, race

Height

Weight

Skinfolds (biceps, triceps, subscapular, umbilical [M], iliac crest [F])

Mid-upper arm and head circumferences.

iv) Hemoglobin

v) Body composition

By anthropometry, and if possible, underwater weighing or total body water.

Body composition

Body composition measurements are essential since $\dot{V}O_2$, $\dot{V}O_2$submax and $\dot{V}O_2$max are closely related to lean body mass. The simplest approach to estimating body composition is to use a prediction equation based on anthropometry. It is assumed that the Nutritional Status TAG will decide on the best prediction equation(s). Spurr et al. (Am J Clin Nutr 34:1944-53, 1981) compared body fat estimates derived from anthropometry and total body water, and found a reasonable correlation (r = >0.8) between the two methods in mildly undernourished adults. However, as nutritional status deteriorated, the magnitude of the correlation coefficient decreased, and it was not statistically significant. It appeared that fat was lost from internal depots, rather than from subcutaneous deposits, as malnutrition became more severe. Therefore, the use of standard prediction equations in malnourished individuals needs to be carefully checked.

At some sites it may be feasible to use under-water weighing to estimate body fat content. The methodology is available to set up this procedure in fairly primitive environments. The Nutritional Status TAG and the SCB should decide if underwater weighing is a desirable core measurement. Concern was voiced that subjects at some sites (especially in Egypt) may object to this procedure.

An alternative approach is to measure total body water and extracellular water using an oral dose of an antipyrine/thiocyanate "cocktail" (see Appendix 4). As shown in Figure 1 of this Appendix 4, the oral dose

appears to give similar results to an i.v. injection, but this needs confirmation in additional subjects. No food can be consumed for at least 2 hours (preferably 8 hours) before the oral dose. This method may be unacceptable to human use committees, and should not be used in pregnant or lactation women.

While it is most desirable to have a good body composition data from pregnant and lactation women, we know of no acceptable method other than anthropometry for this group.

vi) General procedure for fitness testing

Each subject will begin walking at 2.5 mph and 6% grade for a three minute warm-up period. Immediately following this warm-up period, the treadmill speed will be increased to 3.5 mph and the elevation will be increased to 8% grade. At two minute intervals following the warm-up period, the elevation of the treadmill will be increased by two percent to a maximal elevation of 24% grade. The speed of the treadmill will remain at 3.5 mph for 12 minutes, at which time the speed will be increased to 4 mph for the duration of the test. The following is an outline of the aforementioned protocol.

Speed (mph)	Elevation (% grade)	Segment time (min)	Total
2.5	6	3	3
3.5	8	2	5
1.5	10	2	7
3.5	12	2	9
3.5	14	2	11
3.5	16	2	13
3.5	18	2	15
4.0	20	2	17
4.0	22	2	19
4.0	24	2	21

Both submaximal and maximal performance will be determined during this exercise protocol. Following the warm-up period, respiratory gas samples will be collected during the last 30 seconds of each stage according to the procedures described previously.

The justification for the previously described protocol is as follows:

1. The protocol will be able to accomodate all subjects.
2. The length of time that a subject is on the treadmill becomes an important variable for comparisoin reasons.
3. The protocol provides for the measurement of both submaximal performance, at either 8% or 10% elevation, and maximal performance at the termination of the test.

vii) Basal and resting metabolic rate, and respiratory quotient.

RMR should be measured on all subjects prior to fitness testing. Subjects must be at least 2 hours postprandial, and at rest (lying down) for 30 minutes.

BMR, being a more difficult and time-consuming procedure, should only be necessary in adults to be tested in the activity study and in a subsample of pregnant and lactating women with a range of nutritional status (see TAG on reproduction).

Subjects

Subjects must be at least 2 hours postprandial, and have not smoked for at least one hour.

It is recommended that at least 60 subjects be tested in each of the following groups. Data from pre-adolescent males and females can probably be pooled if no significant differences are found between the sex groups at this age. Thus, a smaller sample size (30M + 30F) may be possible for

pre-adolescents.

Group	Age (years)	Number
Pre-adolescent	6 - 9	60 M, 60 F
Adolescent	12 - 15	60 M, 60 F
Adult	21 - 50	60 M, 60 F
Elderly	50	60 M, 60 F
Pregnant		60 F
Lactating		60 F
	Total N	600

Whenever possible, these subjects should come from households in which physical activity is to be measured. For this reason, criteria for selecting the households for activity measurements are relevant for selection of subjects for fitness testing.

The above sample sizes will allow to obtain normative data for each site. If this is not required, then an alternative approach might be to obtain $VO_2max/VO_2submax$ data only on those individuals shown.

Time Requirements

Measurements on from 10 to 12 subjects can be completed each day. Assuming 50 subjects per week, data from all subjects can be collected in 12 weeks. The same individuals should be studied again towards the end of each seasonal change, or at least twice per year. The need for repeating such measurements on all individuals in additional years is not clear. However, longitudinal data on growing children and on pregnant and lactating women may be of interest, as may a current measure of fitness of subjects undergoing physical activity testing. These needs should be discussed by the SCD.

Quality Control and Training of Personnel

There are 3 procedures which should be followed in greater or lesser degree to establish the validity and repeatability of the measurements.

i) Test -- retest.

Groups (10) of (adult male) subjects should be tested twice, about a week apart, with average results of Test 1/Test 2 = 1.00 ± 0.05, (i.e. ± 5%). This should be repeated about once/year after the methodology has been established.

ii) Comparison with established U.S. laboratory.

Program personnel traveling between the site countries and the U.S. should be tested in the field laboratory and in an established exercise laboratory in the United States, using the same treadmill protocol. The time interval between the tests should be as short as possible.

iii) Inter-laboratory comparisons.

Again, personnel who have occasion to visit all 3 field laboratories should be tested in each to assure comparability of results obtained in the 3 site countries.

For the purpose of general oversight of work capacity and physical activity measurements in all 3 countries, it is suggested that the services of a consultant be obtained. This person must be experienced in work physiology and in the set-up of laboratory facilities under field conditions. They must be prepared to oversee the establishment of the laboratories at the beginning of each project, and the on-site training of personnel. This will take from 4 to 6 weeks. After this, he/she should visit each laboratory every 6 months to maintain quality control.

In addition, a scientist from each country (Mexico, Egypt, Kenya) should spend about 3 months in an established laboratory in the United States for training in exercise-testing and energy expenditure measurements. After this person becomes experienced in solving the problems of running their own laboratory, the consultant's visits can be reduced and eventually ended.

If these suggestions are unacceptable (for reasons of logistics or cost), then a system must be documented showing how the necessary expertise and quality control will be attained.

Personnel

A physician and 2 technicians are required to run each laboratory. Ideally, the physician should be the person to receive additional training in exercise testing, and to oversee the technicians and the daily operation of the laboratory. When not engaged in the laboratory testing of fitness, this team should assist in the energy expenditure study.

In a complex study such as this, a chauffeur-handy man should be employed to take care of subject transportation, equipment maintenance, vehicle care, errand-running etc. These tasks are essential to the smooth running of an exercise-testing program.

II. PHYSICAL ACTIVITY

The field research component of activity will evaluate the ways in which energy is expended in individuals with differing degrees of energy deficit. Particular attention will be paid to the ways in which energy is conserved in order for individuals to adapt to low energy intakes.

The Purposes for Which Energy is Expended

i) Resting metabolism (RMR); this represents a considerable proportion of total daily energy expenditure and is approximately 1600 kcal/day for a 65 kg male, and 1300 kcal/day for a 55 kg female.

ii) Physical activity; the energy requirement for activity depends on the intensity and duration of activity, and the muscle masses involved.

iii) Growth in the young; this amounts to only 30 kcal/day for children from 2 to 10 years of age, and 60 kcal/day in adolescents. With the possible exception of energy required for "catch-up" growth after illness, requirements for growth can be ignored as a significant component of daily energy expenditure.

iv) Pregnancy and lactation; in theory, these conditions require increased expenditures of 300 kcal/day and 500 kcal/day, respectively. In practice, increments in intake of this magnitude are rarely encountered, especially in malnourished women. A major goal of this research should be the identification of factors which may reduce energy expenditure in pregnancy and lactation.

In summary, RMR and the type and duration of activity are the most important factors in determining the total daily energy expenditure of an individual. Body weight changes are relatively unimportant components of daily expenditure.

Energy Balance

If energy intake is lower than theoretical requirements, an individual may adapt to the energy deficit by

i) a reduction in physical activity

ii) a reduction in body weight and/or growth stunting

iii) an increased efficiency of energy utilization

i) Reduced physical activity

This may result from a change in the type of tasks performed, a decreased intensity of performance, or a decreased duration of activity. The relative changes in these factors will be assessed in this research. It is important to note that the energy expended in work (obligatory activity) accounts for only 30-40% of the total daily energy expenditure in a variety of working conditions. While there is a strong correlation between energy expended in work and total daily expenditure, the energy expended in leisure (discretionary) activities is substantial. There is some evidence that a decrease in activity during leisure periods, and an increase in time spent resting or sleeping, may be adaptive responses in times of energy deficit. This form of "adaptation" may also have adverse consequences on household competence and social interactions, and therefore should be investigated in this study.

ii) Reduced body weight

In human populations, the correlation coefficient between body weight and energy intake is only 0.2 - 0.5. Thus, especially in the short term, little reliance can be put on the use of body weight as an indicator of energy deficit.

iii) Increased efficiency of energy utilization

There is an increasing awareness that intra-individual differences in the efficiency of energy utilization may explain why data from previous studies show that:

a) intake varies much more widely than expenditure in subjects engaged in similar work,

b) intake and expenditure are not well correlated,

c) individuals engaged in similar work show a mean coefficient of variation in energy expenditure without significant fluctuations in body weight.

An increased efficiency of energy utilization may occur in malnourished individuals. This may be demonstrable as a decreased postprandial thermuc effect, although evidence for this is so far limited. It is therefore proposed that the measurement of postprandial RMR, using a standard meal containing at least 750 kcal, be made in a subsample of well-nourished and malnourished individuals, although not as a "core" measurement of activity.

The efficiency of performing set tasks should also be measured in well-nourished and malnourished subjects performing controlled tasks. One way of achieving this would be to compare the oxygen uptake of these subjects during a set treadmill speed, while adjusting treadmill grade to produce equivalent work loads (kg·m/kg body weight). The well- and malnourished individuals should be matched for height since differences in height affect the efficiency of treadmill walking.

An additional approach is to compare the oxygen consumption and time taken for subjects to perform a set task, e.g. movement of a set number of objects to another location (males), or sweeping a fixed area of floor (females).

The above observations (iii, a-c) have also been interpreted to mean that errors in the measurement of intake and expenditure are too large

to allow a state of balance to be detected in the same individual. Indeed, it is likely that neither energy intake nor energy expenditure can be measured with an accuracy less than 200 kcal/day. Given these limitations of measurement accuracy, in addition to the possibility of changes in the metabolic efficiency of energy utilization, it is unlikely that we will detect short-term variations in the energy balance of an individual. Therefore, this should not be a primary goal of this research, but does not detract from the goal of measuring the effects of variations in energy intake on work performance and activity.

Research Questions -- Physical Activity

1. What is the average daily energy expenditure in various nutritional states?
2. Does malnutrition affect the time spent in various tasks? In obligatory or discretionary activities?
3. Does malnutrition decrease the efficiency with which tasks are performed (increased time or decreased intensity of effort?)
4. As an adaptive strategy (conscious or unconscious) do malnourished individuals conserve energy by
   a) working less strenuously (expending less energy per task)
   b) performing fewer "essential" tasks
   c) non-completion of tasks
   d) sitting instead of standing during task performance
   e) spending a greater proportion of leisure time in non-active pursuits and reducing social participation
   f) spending more time at leisure or in rest
   g) sleeping longer
   h) reallocation of tasks

i) lowering productivity

5. How is physical activity affected, in the range of nutritional states, by:

a) disease

b) pregnancy and lactation

c) household composition and resources

6. What are the positive and negative consequences of the nutrition-related changes in activity?

7. Are any of the observed changes resulting from malnutrition states?

Data Needed to Answer the Questions

1. Time spent in specific tasks
2. Energy expenditure per task
3. Items produced as the result of work (productivity)
4. Data from physical fitness testing (age, sex, anthropometry, physiological state, Hb, body composition, VO_2max or VO_2submax.
5. Data from ethnographic study of household.

Methods

A. Ethnographic phase

In order to select the 60 households to be used for the analysis of physical activity, it is necessary to have prior knowledge of:

a) demographic features:

location of households in the community, distance from resources essential to the household (water supply, market, land, school, etc.), major occupations of community members, typical household structure, household composition, transportation.

b) social features:

Domestic organization, household developmental cycle, social

organization of production (sequence of household tasks, allocation of tasks, role of individual family members, usual tasks, and active and passive leisure activities), survival strategies of households, strategies for coping with illness.

c) local standards of performance:

These are necessary to ascertain local standards of appropriate time allocation, efficiency, value of work and social activities, acceptable productive and emotional styles, attitudes towards the work of various household members (including children, pregnant and lactating women, the elderly).

d) seasonal variations:

The effect of seasonality on production, consumption, work and leisure activities, types of food consumed, task allocation.

From these background data it is necessary to define;

a) the most important tasks to be observed and evaluated in terms of time, intensity of performance and attitude,

b) the most significant dimensions of the household which affect activities related to nutrient intake, child care, production, etc. (e.g. household resources, number and age of children, presence of older family members, presence of pregnant or lactating women).

c) the most important days of the week and seasons to study,

d) cultural standards of performance (e.g. is it acceptable to work less in times of food shortage, after days of intense activity, during or after illness or pregnancy, etc.? Is the cultural norm to strive for energy conservation or for the highest productivity and intensity of effort?)

e) potentially significant adaptive strategies for coping with food shortage.

Personnel required

To obtain the above data it will require:

1. A senior social scientist responsible for designing and coordinating this phase of the research, and for providing data to the leader of the physical activity team.
2. One trained male and one trained female assistant so that both male and female activities can be covered.

Subjects

Much of this information can be obtained by an ethnographic description of the community, and from interviews with community leaders and key informants. Data on the occupations of family members, household composition and household resources will already be available from the preliminary study undertaken for the selection of households.

B. Task observations.

It was agreed that the most valid way to answer the research questions was to observe focal household members for day-long periods. It was realized, however, that such an approach may be impossible or limited in some of the sites by insufficient funds or by subjects' nonacceptance of repeated day-long observations.

The key individuals, and those on whom data can be obtained most easily, are the male and female head of household. The activities of accompanying other household members, including young children, will be observed in as much detail as possible; the recommendations of the TAG on Cognition should be considered in this context.

The data to be collected during day-long observation periods will undoubtedly be of use to the substudies on social competence, reproduction, disease and cognitive development. Such observations also provide an excellent opportunity to obtain additional data on food intake, eating patterns, social interactions, community involvement, child-feeding

practices, household contamination, mother-infant interaction, etc. Thus, while costly and invasive, they will provide data of fundamental importance to all aspects of the project. The SCB should plan to obtain as much data as possible during these periods, without over-taxing or interfering with the activities of the observers or the household members.

DAY 1.

Activities during the first study day will include

a) explanation of the study and what will be required of the participants,

b) simple observation of tasks during most of the day, to gain familiarity with the household,

c) calibration of heart rate monitor for male and female heads of household (by work capacity team). BMR if possible at this time.

DAYS 2 and 3.

The observers will enter the house as soon as possible the next morning. Questions should be asked about the time of retirement the previous night (verified when possible by asking about radio programs, etc.) and the type and duration of activities which have already occurred that day. Heart rate monitors will be attached to the male and female head of household. They will be carefully instructed to carry on with their normal tasks, to leave for whatever location they wish, and to do whatever business is necessary. Males will be followed by a male observer, and females by a female observer.

All activities will be entered on the time-motion form (Appendix 6). This form will include space for a brief description of the activity, the

exact time it was started (to the nearest 0.5 minutes), the estimated weight of loads or children carried, and the nature of the terrain. Subjects will be followed constantly, except when they have to attend to personal needs when time allocations will be approximated. Prior criteria will be set about how to code activities which occur simultaneously.

The observers will remain in the household for as long as possible at the end of the day. It may be possible to use just the female observer at this time. If unobserved, activities in the evening should be questionned on the following morning. The monitors should be removed at the latest possible time each day, either by the observer or the subject.

Additional forms will be kept for all other members of the household, by each observer. When these members are visible, their activities can also be recorded, although this will probably be done less precisely since attention must remain focussed on the heads of the household. When the members are absent, questions should be asked about the way in which their time was spent. The purpose of this semi-quantitative data will be to obtain information on task allocation among household members, the activities of children, etc.

Records must be kept of other events which might affect activity. For example, pregnancy, lactation, illness or recovery from illness, recent strenuous or leisurely activities, household or community celebrations, interventions from outside the household.

Productivity will be recorded in terms of relevant items produced as the result of work, e.g. weight of grains ground, number of tortillas made, amount of crop harvested, etc. Oxygen uptake should be related to the quantity produced and the time taken.

C. Heart rate monitoring.

Heart rate has been shown to correlate directly with oxygen consumption (energy expenditure) over the range of usual activities. It therefore provides a relatively non-invasive method of measuring, i) total daily energy expenditure, ii) the energy expended in various tasks. Most importantly, for the purposes of this study, monitors will allow determination of the intensity with which a task is performed. Intensity can only be quantitatively assessed by an observer.

There are varying opinions about the validity of the heart rate recording method. Many investigators have found a good agreement between expenditures calculated from heart rate data and those derived by respirometry. Other workers have found the error to be unacceptably large. It was agreed that this potentially valuable method should be explored further in the present study.

The disadvantages of the heart rate monitor method include:

i) the non-linearity of heart rate and oxygen consumption at low and high activity levels. There is a disagreement about the cut-off points for linearity, but it appears that heart rates underestimate oxygen consumption when rates are less than about 80 beats/minute (during sleep, and possibly during sitting). Heart rate overestimates oxygen consumption when energy output is very high, but this requires unusually demanding activities. In the present study, it would be possible to reject heart rates above and below the determined range of linearity, and to substitute energy values obtained by respirometry.

ii) a regression line of heart rate against oxygen consumption must be obtained for each individual to be studied. This can be done

on Day 1 of activity testing. The subject will perform tasks of increasing intensity, and oxygen consumption will be measured with a respirometer at each heart rate level. The tasks performed during calibration should represent a range of typical activities.

iii) electrodes can become detached, so the observer must intermittently check their adherence. Ocassionally, the skin becomes irritated under the electrodes.

iv) other factors, such as alcohol consumption, smoking, and environmental stress, decrease the slope of the regression between heart rate and oxygen consumption. However, these factors do increase oxygen consumption to some extent, which will go undetected if the monitor is not used. Thus, the use of the heart rate monitor is anticipated to overestimate the effects of these factors on energy expenditure by a small amount, whereas the use of energy values derived by respirometry will underestimate their effects. When observed, smoking, alcohol consumption, and increased emotionality must be recorded, so that it may be possible to account for their effects during subsequent data analysis.

Consideration should also be given to the usefulness of obtaining day-long heart rate data without prior calibration to oxygen consumption, in the absence of observers. In this situation, values could be set for the beats per minute associated with various activity levels (sedentary ⟶ very active), and an evaluation made of the effect of nutritional status on the amount of time spent at each level. This approach might be particularly useful for studying the entire sample of pregnant and lactating women. In addition, random spot observations, or scheduled observations, may

provide useful information about how the time was spent.

D. Respirometry.

Until the development of heart rate monitors, respirometry was the accepted method of measuring energy expenditure and the energy cost of various tasks. In this study, its value is perceived as follows:

i) as a check against the heart rate method

ii) to obtain values for oxygen consumption below and above the linear portion of the heart rate regression curve

iii) values for the energy costs of various activities can be obtained prior to observation days. These measurements can be made by the physical fitness laboratory personnel during periods when laboratory tests are not being performed.

The disadvantages of using respirometry as the sole method of obtaining expenditure would include:

i) the respirometer cannot be worn for more than short periods of time. Consequently, it is necessary to derive an estimated 'average' value for the energy cost of each task, or more usually, for catogories of tasks ranked by intensity. While experienced technicians can detect when an activity is being performed at its 'usual' intensity, in this study it is essential to be able to quantify the intensity with which a task is performed in different nutritional states, at different times during the day, during interference from other distractions, and at different times between the initiation and completion of each task. Recovery from each task is also of interest.

ii) due to the "Hawthorne Effect", the intensity with which tasks are performed are likely to be higher during the relatively short periods of time that a subject is attached to a respirometer, than they are when the task is performed in the presence of normal household distractions, or for longer periods of time.

Subjects

Subjects will be the male and female heads of household in 60 households. These households should contain a range of nutritional status, and contain individuals whose physical activity has been assessed. In addition to selection on the basis of nutritional status, it is important to consider the ethnographic data obtained on each household, e.g. the number of adults, the number and age of children (labor-demanding and productive), the major activities of the household, household structure, resources for food preparation and acquisition, transportation, etc.

It should be noted that N=60 was selected without sufficient data to ensure the adequacy of this sample size. The TAG is presently attempting to acquire data on the variability of energy expenditure from previous studies. In previous studies involving nutrition, however, the range of nutritional status has typically been wider than will be the case in this study. An additional major consideration must be the number of personnel available to perform this research in each project.

Time Requirements

Subjects should be measured on sufficient occasions to permit assessment of:

i) the typical activity profiles during the usual activity cycle, i.e. weekly? The necessary frequency will depend on the intra-individual variability in activity. Weekends must be included in the sampling process.

ii) the seasonal impact on nutritional status and activity. This will depend on the number of seasons per year.

It is suggested that the period of observation be 3 days, but that quantitative data be obtained during only the last 2 days of this period. The value of using consecutive days includes:

i) calibration curves obtained during Day 1 can be used during both Days 2 and 3

ii) increased familiarity with household, and with observer

iii) ability to check on previous evening activities if not observed

iv) reduces number of occasions per year when household is entered

v) ability to follow the longitudinal effects of illness

vi) ability to follow the effects of heavy work days on the intensity, type and duration of activity on the subsequent day.

PERSONNEL

One observer is required per subject day of observation, or 2 observers per household. The same observer should be assigned to the same households for the duration of the study, to minimize the unfamiliarity of the household with the observer, and of the observer with the household. In some communities, local personnel will be most readily accepted by the subjects, whereas in others (e.g. Mexico), households prefer observers to

be persons from outside of the community.

An approximation of the number of personnel is as follows: Assuming that each household is measured twice during each of 3 seasons, and that each observation period is 3 days, and allowing 1 day for checking and coding of data, then 1 male and 1 female observer spend 24 days per year on each household. Assuming 240 working days per observer per year, they can collect data on 10 households. To cover 60 households, 6 male and 6 female observers per year will be required.

These personnel should have at least a secondary school education, have a high motivation, possess the ability to be unobtrusive, be sensitive to the needs of the household, and be able to record on code sheets and perform simple addition. Training will include the heart rate monitor tests and calibrations, ability to classify tasks, use of code sheets, and knowledge of additional observations required. Therefore, both a work physiology technician and an anthropologist should be involved in the training process.

It is also recommended that a team leader be identified. This would be an additional position, with the responsibility of coordinating and scheduling activities, tallying and checking code sheets, coding heart rate data, etc.

EQUIPMENT (forwarded separately)

The equipment list should be approved by the SCB as soon as possible, since the purchasing and transportation of equipment is likely to take several months. The field testing of methodologies cannot take place until equipment has arrived at the field site.

BUDGET

This budget is tentative;

Equipment for laboratory testing of fitness, air conditioners, etc, as required for lab	$31,000
Equipment for field (includes 14 Bio-Log heart rate monitors at $900 each. Cheaper systems may be available and are being checked).	18,000

Personnel:

1 physician	1-2 years
2 lab technicians	1-2 years
1 senior anthropologist	4 months
2 assistants	4 months
1 field leader	2-3 years
12 assistants	2-3 years

APPENDICES

APPENDIX 1

JUSTIFICATION FOR MEASURING $\dot{V}O_2$ MAX

The direct measurement of $\dot{V}O_2$ max is the standard for the assessment of physical fitness and working capacity and was accepted by the International Biological Programme (IBP) as the international reference standard of cardio-respiratory fitness (1). The procedure is quite safe when adequate precautions are observed:

1) Medical examination of subjects with exclusion of all with cardiac or hypertensive disease or arrythmias, restrictive or obstructive respiratory diseases, and any musculo-skeletal disease or defect which would endanger the subjects' safety while performing on the ergometer.

2) Continuous recording of an adequate precordial ECG with particular attention to S-T segment changes which might signal myocardial ischemia.

3) Adequate personnel present (at least 3) during the procedure to collect the necessary data and to aid the subject in the unlikely event of an accident. Disagreement exists about the necessity for the presence of a physician and the need for a defibrillator in the laboratory during the test. On the basis that subjects from even the most primitive of societies deserve the same protection as those from more advanced groups, both are recommended (1). Furthermore, at least one of the laboratory personnel should have CPR training.

4) Some question exists about coronary-prone middle-aged subjects and to avoid this risk (where the danger of ventricular fibrillation or cardiac arrest is about 1 in 3000 and drops to about 1 in 15,000 in the general population (1)), sub-max testing in subjects over 50 years of age and in pregnant women is recommended.

We have tested approximately 1500 normal and undernourished adults and children (6-16 years of age) in Cali, Colombia during the past several years without untoward incidents. The one exception has been the occurrence in 3-4 subjects of exercise-induced asthma attacks, where the possibility of these went undetected in the preliminary medical history. Their occurrence is a signal for immediate cessation of the test with subsequent rapid recovery. For this reason, we keep handy one of the nebulizers in current use for treatment of asthma patients.

G.B. Spurr

G.B. SPURR, Ph.D.
Professor of Physiology

References:

(1) Shepard, R.J. Human Physiological Work Capacity. Cambridge Univ. Press, New York, 1978, pp. 22-46.

APPENDIX 2

CALCULATIONS OF PHYSICAL FITNESS SCORE

Name: _____ Date: _____

1. Wt. (kg) = _____
2. Resting diastolic blood pressure: _____
3. Resting pulse pressure: _____
4. Submax. pulse rate: (Stage III): _____
5. % Lean body wt. (kg): _____
6. Submax. minute volume ventilation/kg lean body wt. (Stage III): _____
7. $\dot{V}O_2$ ml/kg lean body wt: _____

-1.33 (#4) = _____

4.88 (#5) = _____

2.50 (#6) = _____

-119.02 (#7) = _____

-1.36 (#2) = _____

1.31 (#3) = _____

61.90 (constant) = _____

Physical Fitness Score = _____

APPENDIX 3

HEALTH QUESTIONNAIRE

Name: _____ Date: _____

House: _____ Sex: M___ F ___

A. GENERAL HEALTH

1. Would you say your health is Excellent ___ Average ___ Poor ___

2. When did a doctor last examine you? _____

3. In the past few years, have you had headaches often? (at least one every few days). If yes, indicate: Yes ____ No ____ Mild ___ Moderate ___ Severe ___

4. Do you have trouble "catching your breath" when working hard or running? Yes ____ No ____

5. Are you sometimes awakened because of breathing difficulties? Yes ____ No ____

6. In the past few years, have you ever experienced any chest pains? (If no, omit questions 7-10). Yes ____ No ____

7. If yes, did this pain include tightness in the chest? Yes ____ No ____

8. If yes, indicate the location of the chest pain:

   Front ____ Back ____ R. Side ____ L. Side ____

   Middle ____ L. Arm ____ R. Arm ____ Lower Jaw ____

9. Does the pain usually remain in one place? Yes ____ No ____

10. When does the pain occur:

    Only during exercise ____ At anytime ____ When upset ____

11. Do you have reason to believe you may have heart trouble? Yes ____ No ____

12. Do you have any illnesses we should be aware of? (e.g. asthma, epilepsy, heart disease, diabetes, missing or damaged part of body, anemia, etc.) Yes ____ No ____

Appendix 3
Health Questionnaire (cont.)

13. If yes, please fill in the following table where appropriate:

Names of illness/disability	Medication (if any)	Dosage	Times taken per day

B. DRINKING

1. Do you drink alcoholic beverages at the present time? Yes ____ No ____

2. If yes, how often do you drink per week (circle). 1, 2, 3, 4, 5, 6, 7

3. How much do you usually drink each day? _____

C. SMOKING

1. Have you ever smoked cigarettes? Yes ____ No ____

2. Do you smoke cigarettes at the present time? Yes ____ No ____

3. If yes, about how many cigarettes per day? _____

4. If you no longer smoke, how many did you previously smoke per day? _____

5. Do you cough often? or for a long time? Yes ____ No ____

APPENDIX 4

EXTRACELLULAR FLUID AND TOTAL BODY WATER

COCKTAIL PREPARATION:

For each 100 g of cocktail:

Fresco Royal (soft drink)		7.4 g
Sugar		20.0 g
Antipyrine		3.0 g
Thiocyanate		.75 g
H_2O	to	100.0 g

Prepare sugared Fresco Royal and separately weigh antipyrine and thiocyanate. Bring quantites indicated to 100 g with Fresco Royal.

REAGENT FOR ANALYSIS:

1)	Antipyrine	Standard 25 µg/ml (2.5 mg%)
2)	H_2SO_4	0.77 N (reagent quality)
3)	$NaNO_2$	0.1%
4)	Thiocyanate	Standard 30 µg/ml (3 mg%)
5)	$Fe(NO_3)_3$	$Fe(NO_3)_3 \cdot 9\ H_2O$ (MW 4404.00) 8 g HNO_3 1.12 N 27.9 ml H_2O to 50 ml. This reagent is LIGHT SENSITIVE! Avoid daylight.
6)	TCA	7.5%

ALTERNATIVE COCKTAIL SAMPLES:

Thiocyanate	Dilute 1 ml of Cocktail → 100 ml H_2O
Antipyrine	Dilute 1 ml of Cocktail → 250 ml H_2O

Take 1 ml of cocktail dilution plus 2 ml of TCA and get protein-free filtrate (PFT) for thiocyanate and antipytine; proceed in the same manner as with sample.

Appendix 4
Extracellular Fluid and Total Body Water (cont.)

ANTIPYRINE	H_2SO_4	25 µl
	H_2O	200 µl
	PFF	25 µl
	$NaNO_2$	5 µl
THIOCYANATE	H_2O	25 µl
	$Fe(NO_3)_3$	200 µl
	PFF	25 µl

NOTE: The standards of Thiocyanate and Antipyrine and $NaNO_2$ should be fresh; keep at maximum 2 days; the $Fe(NO_3)_3$ will last 15 days.

METHODOLOGY:

1) Subject 2 hrs postprandial (light meal) (Better if 8 hrs.)
2) Have subject empty bladder. Take sample for urine blank.
3) Weigh container before and after subject ingests cocktail.
4) The subject must not have any liquids for the duration of the test.
5) Approximately 1 g of cocktail/kg body weight should be used.
6) Finger stick blood samples at 0, 2, 3, 3.5, 4 hours. (Collect at least 2 heparinized capillary tubes each time.)
7) Subject must not urinate during the total period of blood collection, or any urine samples must be collected.
At end empty bladder, measure volume and take sample for determination of antipyrine and thiocyanate. Amount excreted subtracted from amount ingested for volume calculations.

PROTEIN FREE FILTRATE FOR SAMPLES (PFF):

From each capillary tube (i.e. those used for hematocrit determination) one obtains about 26 µl of plasma. From 2 (or 3) capillaries, take 50 µl plus 100 µl of TCA and centrifuge for 60 min at 4000 rpm. From this one obtains about 60 µl of protein-free filtrate. One can use 50 µl of H_2O + 100 µl of 7.5% TCA protein-free filtrate for standards and blank.

Appendix 4
Extracellular Fluid and Total Body Water (cont.)

Antipyrine standard curve	µl					
	B1	1	2	3	4	(Samples)
Standard	0	25	10	5	0	
H_2SO_4	25	25	25	25	25	
H_2O	200	175	190	195	200	
PFF	25*	25*	25*	25*	25	
	Read OD at 350 mu					
$NaNO_2$	5	5	5	5	5	(15 minutes)

Thiocyanate standard curve	µl					
	B1	1	2	3	4	(Samples)
Standard	0	25	10	5	0	
H_2O	25	0	15	20	25	
$Fe(NO_3)_3$	200	200	200	200	200	
PFF	25*	25*	25*	25*	25	

The color intensity can be measured 15 minutes after the addition of the $Fe(NO_3)_3$ with 500-600 mu filter.

Chemical methods adapted from:

1) Brodie, B.B. Measurement of total body water methods. Medical Research 4:31, 1957.

2) Eder, H.A. Determination of tiocyanate space. Medical Research 4:40, 1951.

Table 35

Extracellular fluid volume, total body water and body composition obtained in 11 normal boys by the oral ingestion of sodium thiocyanate and antipyrin compared to calculated values from the literature.

Subject Code	Age Yrs	BW[1] Kg	Extracellular Water				Total Body Water				H.C.[5]	LBM[6]		FW[7]	
			obs. Liter	% BW	Calc[2] Liters	Δ[3] Liter	obs. Liters	% BW	Calc[4] Liters	Δ[3] Liters		Kg	% BW	Kg	% BW
04-058	7.0	23.88	5.40	22.6	6.34	0.94	14.08	59.0	0.76	0.76	0.715	19.7	82.5	4.2	17.5
04-093	9.5	30.20	7.53	24.9	7.77	0.24	19.29	63.9	18.70	-0.59	0.725	26.6	88.1	3.6	11.9
04-161	10.2	32.25	11.70	36.3	8.24	-3.46	20.59	63.8	19.96	-0.63	0.774	26.6	82.5	5.6	17.5
04-143	8.5	27.72	8.67	31.3	7.21	-1.46	17.00	61.3	17.19	0.19	0.752	22.6	81.5	5.1	18.5
04-173	9.5	28.00	7.93	28.3	7.27	-0.66	15.52	55.4	17.36	1.84	0.744	20.9	74.5	7.1	25.5
04-172	11.0	31.90	9.06	28.4	8.16	-0.90	18.91	59.3	19.74	0.83	0.743	25.4	79.8	6.5	20.2
04-153	11.5	32.25	7.82	22.2	8.92	1.10	20.11	57.0	21.79	1.68	0.717	28.0	79.6	7.2	20.4
04-156	9.8	31.05	6.72	21.6	7.96	1.24	17.82	57.4	19.22	1.40	0.713	25.0	80.4	6.1	19.6
04-178	13.9	41.30	10.37	25.1	10.29	-0.08	26.29	63.6	25.48	-0.08	0.728	36.1	87.4	5.2	12.6
04-095	9.0	25.73	5.19	20.2	6.76	1.57	15.85	61.6	15.97	0.12	0.703	22.5	87.6	3.2	12.4
04-150	10.5	37.40	8.44	22.6	9.40	0.96	23.69	63.3	23.10	-0.59	0.716	33.1	88.4	4.3	11.6
$\bar{X}$	10.1	31.06	8.07	25.8	8.03	-0.04	19.01	60.5	19.40	0.39	0.730	26.0	82.9	5.3	17.0
S.D.	1.8	5.00	1.94	4.9	1.17	1.50	3.61	3.0	3.14	0.98	0.020	5.0	4.5	1.4	4.5

1 Body weight
2 Calculated from Mellits and Cheek (2); ECW = 0.227 · BW + 0.916
3 Difference = Calculated - Observed
4 Calculated from Cheek and Grayston (3): TBW = 0.611 · BW + 0.251
5 Hydration coefficient from Moore and Boyden (4)
6 Lean body mass
7 Fat weight

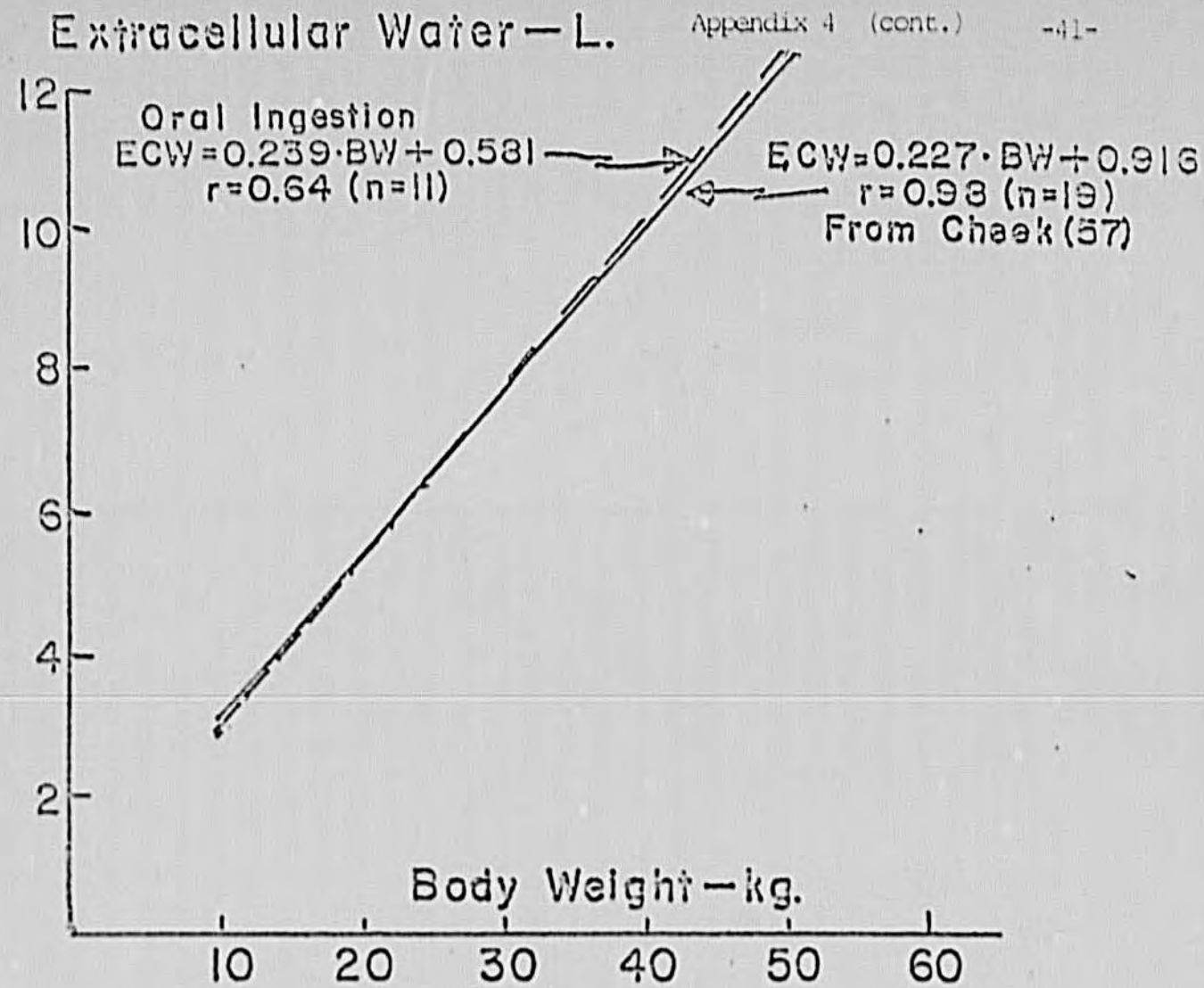
REFERENCES FOR TABLES 33 AND 35

1. Tanner, J.M. Growth At Adolescence. 2nd ed. Oxford, Blackwell, 1962.

2. Cheek, D.B. and Graystone, J.E. Intracellular and extracellular volume (and sodium), and exchangeable chloride in children. In: Human Growth, D.B. Cheek, ed. Philadelphia, Lea and Febiger, 1968, p. 152.

3. Mellits, E.D. and Cheek, D.B. Growth and body water. In: Human Growth, D.B. Cheek, ed. Philadelphia, Lea and Febiger, 1968, p. 137.

4. Moore, F.D. and Boyden, C.M. Body cell mass and limits of hydration of the fat-free body: their relation to estimated skeletal weight. Ann. New York Academy of Science. 110:62, 1963.



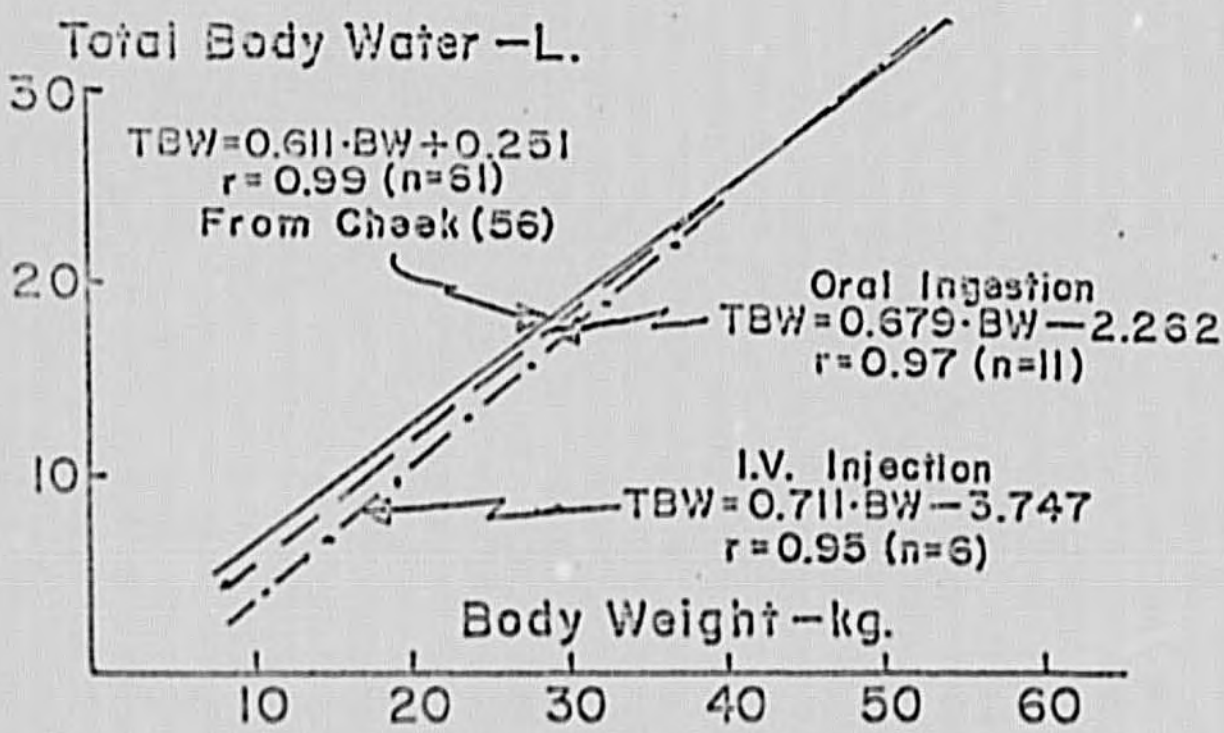


Fig. 11. comparison of the present data with that of Cheek (56,57)

APPENDIX 5

PRELIMINARY CODE SHEET -- PHYSICAL FITNESS

Variable name	Units	Abrev	Columns	Input code (F)
Site number	num	ST	2	2
Subject number	num	SJ	4	4
Sex (1 = M)	num	SX	1	1
Race (1 = W, 2 = N)	num	RC	1	1
Age 1	yrs	AY	2	2
Age 2	mo	AM	2	2
Weight	kg	WT	4	2.2
Height	cm	HT	4	3.1
Pregnant (0 = no, 1 = yes)	num	PG	1	1
Lactating (0 = no, 1 = yes)	num	LC	1	1
Biceps SF	mm	BI	3	2.1
Triceps SF	mm	TR	3	2.1
Scapula SF	mm	SC	3	2.1
Umbilical SF	mm	UM	3	2.1
Iliac SF	mm	IC	3	2.1
Arm circumference	cm	AC	3	2.1
Head circumference	cm	AC	3	2.1
% Fat	num	FT	3	2.1
% Hemoglobin	num	HB	3	2.1
Occupational intensity	met hr	OI	3	2.1
Sports intensity	met hr	SI	3	2.1
Recreational intensity	met hr	RI	3	2.1
Transp. intensity	met hr	TI	3	2.1
Sleep	met hr	SL	3	2.1
Health (1 = exc 2 = avg 3 = poor)	num	HL	1	1
Illness	num	IL	2	2
Medications	num	MD	2	2
Daily alcohol	liters	AL	3	1.2
Smoke per day	cigs	SM	2	2
Previous smoke/day	cigs	SN	2	2

(continued)

Appendix 5
Preliminary Code Sheet - Physical Fitness (cont.)

Variable name	Units	Abrev	Columns	Input code (F)
Resting heart rate	min^{-1}	RH	3	3.0
Resting systolic	mm Hg	RS	3	3.0
Resting diastolic	mm Hg	RD	3	3.0
Resting pulse	mm Hg	RP	3	3.0
Resting CO_2 production	l/min STPD	CFO	3	1.2
Resting O_2 consumption	l/min STPD	OFO	3	1.2
Final work load				
Speed	mph	SF	2	1.1
Grade	%	GF	3	2.1
Ventilation	l/min BTPS	VF	5	3.2
CO_2 production	l/min STPD	CF	3	1.2
O_2 consumption	l/min STPD	OF	3	1.2
Heart rate	min^{-1}	FF		
Final work load -1				
Speed	mph	SF1	2	1.1
Grade	%	GF1	3	2.1
Ventilation	l/min BTPS	VF1	5	3.2
CO_2 production	l/min STPD	CF1	3	1.2
O_2 consumption	l/min STPD	OF1	3	1.2
Heart rate	min^{-1}	FF1	3	3.0
Final work load -2				
Speed	mph	SF2	2	1.1
Grade	%	GF2	3	2.1
Ventilation	l/min BTPS	VF2	5	3.2
CO_2 production	l/min STPD	CF2	3	1.2
O_2 consumption	l/min STPD	OF2	3	1.2
Heart rate	min^{-1}	FF2	3	3.0
Max 1 = yes 2 = no	num	M	1	1.0
Recovery heart rate	min^{-1}	FF3	3	3.0

PAGE
/

APPENDIX 6

SAMPLE TIME-MAPPING FORM

Name of Subject: _____ Community: _____

Observer	Subject ID	Card	Community	Date	Family ID	M/F	Preg	Lact
1-3	1-4	5-6	7-8	9-14	15-18	19	20	21
- - -	- - - -	- -	- -	- - - - - -	- - - -	-	-	-

Order of activity	Activity code	Body posn	Wt load	Velocity	Terrain	Description of Activity
22-24	25-26	27	28	29	30	31-32

Time			Comments
Hour	Min	Secs	
33-34	35-36	37-38	

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45

Report of the Technical Advisory Group on Cognition

Original Proposal: March 17-18, 1982
Austin, Texas

Proposal Revision: June, 1982
West Lafayette, Indiana

Members: Theodore D. Wachs (Chairman-Egyptian Project)
Tiffany Field (Mexico Project)
Emmy Werner (Kenya Project)
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(With additional input from Gordon Finley-Mexico Project)

Index

I. Overview

II. Problems to be Investigated

III. Design and Statistics

IV. Variables

- A. Cognitive
- B. Behavioral
- C. Interactional-Environmental
- D. Temperamental
- E. Language

V. Testing Sites

VI. Personnel

VII. Relationships with Other Areas

VIII. Coding

IX. Interproject Standardization

I. Overview

It has become increasingly clear that the relationship between chronic, mild malnutrition and subsequent development is not a simple, linear relationship. Rather, this relationship can best be described as "synergistic." By synergistic we mean that there are a variety of factors that covary with chronic mild malnutrition. These factors may serve to either magnify or diminish the impact of chronic, mild malnutrition upon development. Potentially relevant factors which covary with chronic mild malnutrition include chronic morbidity, disturbances in caretaker-child interaction patterns, and the child's own individual, behavioral characteristics (growth patterns, characteristic patterns of activity level).

One of the major implications that comes from the adaptation of a synergistic model for chronic, mild malnutrition is the critical importance of studying malnutrition in a multidimensional, prospective, developmental framework with measurements being obtained even before signs of mild malnutrition appear. Obtaining data only after the appearance of chronic mild malnutrition, as is done in traditional studies, means the loss of data on parameters (such as early infant-parent transactions, maternal caloric intake during pregnancy or degree of fetal malnutrition) which may either influence outcome or predispose to a child becoming malnourished. Looking only at the relationship of malnutrition upon cognition, without considering the inpact of factors associated with chronic malnutrition would limit our understanding of the nature of the relationship between malnutrition and cognitive outcome. Further, given the possibility that the interrelationship of the various factors influencing outcome may change as the child develops, studying the impact of chronic mild malnutrition and its correlates at only one of several ages may lead to oversimplification, or overgeneralization of results.

Using a synergistic model, ideally we would be proposing to study the impact of chronic, mild malnutrition and its correlates upon various cognitive and behavioral parameters from infancy through childhood and into adulthood. However, design limitations of the present CRSP (two year limitation on data collection; restricted population base) make this ideal nonfeasible. Therefore, in terms of cognitive development, our proposed focus will be a short term longitudinal design. Our proposed target population will be newborns plus sibs who are below 24 months of age, in areas where there is endemic chronic mild malnutrition. To lend organization to our report, our proposal is designed around two specific problems, to be described below. Both problem areas, derived from a review of the available literature, center around the issue of predictors of cognitive and behavioral development.

In proposing to focus on infants we fully recognize the limited nature not only of the questions posed, but also of the answers to be obtained. By proposing a short term longitudinal follow-up design we will be working with a smaller than desired sample size. By necessity this will mean not only lowered power, but also a limitation on the number of variables we can investigate. Thus, our results must be viewed only as exploratory, in terms of suggesting predictors that must be taken into account either in future research or in terms of intervention. We feel, however, that such a limited approach is preferable to the use of a non-prospective design. Our conclusion is based on two factors. First, by not utilizing a longitudinal design we would be ignoring the influence of earlier predictors and thus be violating the developmental synergistic model that has been proposed. Second, while it could be argued that valuable data could be obtained on change in cognitive performance as a result of concurrent nutritional or environmental factors, such an argument ignores the reality of the process of cognitive development. Specifically, the increasing stability of cognitive performance after 24 months means

that cognitive retests must occur at times distant enough from the original test to allow a meaningful change to occur. A two-year limit on data collection would not allow sufficient time to pass to reveal sufficient variability in cognitive performance changes. Hence, our decision was to use a short term longitudinal approach as our primary focus. However, to aid the work of other CRSP sections, if specific cognitive measures are requested for a given population at a given age, we will be happy to provide such tests.

Problems to be Investigated

Problem 1: Development of a cumulative risk index.

Although children exposed to chronic, mild malnutrition and its correlates are at a greater than average risk for potential cognitive deficits, it is unclear as to exactly what are the specific factors that place one child at greater risk than another. To answer this we propose to develop a cumulative risk index for infants living in areas characterized by chronic, mild malnutrition. The notion of a cumulative risk index is not new. Such indexes have been successfully developed for other populations such as premature infants. The development of a cumulative risk index is essentially an attempt to summarize, for a given group of children at a given age, which factors are most predictive of subsequent cognitive problems. In the present study we will use both nutritional and non-nutritional parameters. A longitudinal strategy is critical here in that the factors associated with risk at one age may not be predictive of risk at earlier or later ages.

Given the interdisciplinary nature of the CRSP, we will be utilizing biological, medical, social and behavioral parameters. We will also be including a variety of potential outcomes. Given the distinct possibility that there may be different types of risks having different outcomes, to avoid oversimplification it is critical to include multiple predictor and criterion variables. An example of this would be the impact of mild malnutrition with or without iron deficiency. It has been hypothesized that mild malnutrition without iron deficiency

may have different cognitive consequenses than mild mal-nutrition plus iron deficiency. The use of a longitudinal strategy in developing our cumulative risk index will also allow us to utilize malnutrition as a criterion as well as a predictor variable. That is, sex of child, family structure, disturbances in parent-child interactions, or chronic disease may help us identify which children are more likely to become malnourished prior to the actual time of malnourishment.

Development of a risk index has been both scientific and applied value. The scientific value is seen in that such an index helps us to identify the relevant factors that interface with chronic, mild malnutrition, to influence cognitive outcome. The applied value is seen in that such an index allows us to identify which subgroups of children are most in need of intervention. This is especially critical when we must deal with the problem of whom to allocate scarce resources to. If subgroups of children at greater risk can be identified, intervention could be targeted just at these children, rather than attempting to spread scarce resources equally among children who may or may not be at risk.

Further, by comparing the risk indexes found in each of our three target populations (Egypt, Kenya, Mexico), it may be possible to divide our risk factors into universal risks (found in all three sites) versus culture specific risks (found to be predictive in only one culture). This will have implications not only for intervention but also in terms of our understanding of the process by which chronic mild malnutrition and its correlates become translated into cognitive performance.

Problem 2: The invulnerable child.

The idea of a cumulative risk index assumes that it will be possible to identify children who are at risk for subsequent cognitive deficits, as a function of a specific number of parameters impinging upon the child at a specific age. However, even with the best risk indexes children are found who

should have negative outcomes based on their risk scores, but who, nonetheless, develop normally. Children living in high-risk conditions but who develop normally are often called "invulnerable" or "resilient." The use of our comprehensive short-term longitudinal design will allow us to identify not only specific nutritional and non-nutritional factors leading to cognitive deficit, but also to identify children growing up in risk conditions who appear to be invulnerable. Even more important, such a design should enable us to tentatively identify some of the parameters that make these children invulnerable. Thus, among the potential factors that could make a child resistant to the impact of chronic mild malnutrition and its correlates would be the timing of the malnutrition, an absence of disease associated with malnutrition, the degree of interactional stimulation the child receives from its caretakers, the role of other generations in the caretaking process (younger sibs, grandparents) and the child's individual, temperamental characteristics which may help to buffer a child against stress. Again, looking across cultures we can determine which of these buffering factors are universal and which are culture specific. Further, by studying children longitudinally we can determine whether the same factors that buffer a child against the impact of chronic mild malnutrition and its correlates at one age are similar or different from those that buffer a child at a second age. Identification of factors that buffer children may allow us to design intervention strategies based on these specific factors.

Design and Statistics

Subjects

The basic design we are proposing is a prospective short-term longitudinal follow-up of infants born in the target villages. Two groups of infants will be utilized, our primary target group will consist of all infants born in our target

households during the duration of this project, who will be followed up until the time the project is terminated. Our second target group will be infants who are below 18 months of age at the start of the project. In obtaining our population it was strongly recommended that stratification not be utilized as a means of selection. Stratification typically involves the selection of extreme groups which lowers the probability of generalization to less extreme groups. Further, stratification assumes that the problem has already appeared, thus making it impossible to get prospective risk scores. Given the fact that the household is the designated unit of study, our technical group strongly recommends that all babies born to households in our project be studied. To increase generalizability, it was further recommended that samples be drawn from a variety of villages rather than from a single village.

Instruments: Measurement of Cognitive Status--Birth-24 Months

Given the fact that specific tests must be adjusted to account for cultural variation, it must be stressed that the emphasis of our group was on the measurement of cognitive processes rather than on using specific tests. Our advisory group felt that the optimal procedure would be to develop new measures of specific processes. However, it was also realized that it would be extremely difficult to develop satisfactory new measures in the time period allowed. Given this, the committee opted to utilize the best available process measures, with emphasis on measures that were sturdy (i.e., could be utilized effectively under field conditions), which were potentially generalizable and which would have some social meaning. A description of the specific measures utilized at different ages is to be noted below. In the measurement of cognitive parameters in infancy our group recommended a three month measurement cycle. This cycle is in the opinion of our group, far enough apart to reflect stable developmental changes, but not so close as to overload individual families.

A. Cognitive Assessment Procedures. The measures described in this section are those which have been traditionally labelled as "cognitive" in nature. Starting at 3, 6, 9 and 12 months of age all infants in our longitudinal target group will be administered the Motor Scales from the Bayley Scales of Infant Development. These scales were chosen on the basis of previous evidence demonstrating their responsivity to malnutrition in the first year of life, plus the fact that these scales can be broken either into specific cognitive clusters such as goal directiveness and fine motor performance or into specific situation codes reflecting the nature of the test material involved. Since some Bayley Motor items may have to be modified for use in different cultures, the specific processes derived from the Bayley Motor scale items will be decided upon at a later meeting by the senior investigators in the cognitive area, once they have each observed administration of this measure in their respective cultures. At 12, 15, 18, 21, and 24 months of age the longitudinal target group of infants will be administered the Uzgiris-Hunt Infant Psychological Development Scales. These scales of sensorimotor development measure cognitive functioning in eight specific areas. Of particular relevance here will be the infant's performance on the scales of object permanence (tapping memory and attention), means end performance (tapping persistence) and verbal and gestural imitation (tapping the infant's orientation toward persons).

At 24 months of age our longitudinal target group of infants will also be administered the Mental and Motor scales from the Bayley Scales of Infant Development. Again, item groups from these scales will be clustered on various process dimensions such as goal directiveness, persistence and verbal skills.

B. Behavioral Measures. In addition to purely cognitive measures, the technical group thought it critical to assess other process measures of behavioral functioning. These measures, though not traditionally cognitive, are critical for understanding the extent of impact of chronic mild malnutrition and its correlates upon development.

To give us a measure of the infant's initial behavioral competencies, the committee recommended the use of the Brazelton Neonatal Assessment Scale to be given, ideally, within the first week of life. The Brazelton scales give us measures of the infant's motor reflex levels, as well as its' capacities to modulate state, respond to stress and interact with adults. The committee felt that it would be especially relevant to look at specific Brazelton process scores in infants where there was or was not evidence of fetal malnutrition, as assessed by anthropometric measurements such as the ponderal index.

Another measure that was emphasized was that of infant activity. Assessment of this measure was thought to be particularly critical in terms of evaluating the infant's interactions with its environment. It was the committee's recommendation that, starting at 1 month of age and continuing at monthly intervals, samples of infant activity be taken utilizing a standard actometer. This is a device which can be fastened on to an infant or toddler's wrist and which measures the degree of activity exhibited by the infant or toddler. Ideally, this instrument should be left on for a 24-hour period once each month to obtain a reading of the infant's activity level. These readings could be taken by the individual who was doing the monthly home observations.

Although activity can be construed as a measure of exploration, the committee felt it critical to separate these two dimensions as much as possible. Thus, starting at 6 months of age, the committee recommended assessment of level of infant exploration through the use of the infant's toy play schemes. Specifically, infant's would be given culturally appropriate toys or objects and the patterns of behavior exhibited by the infants toward these toys would be recorded. Several measures can be obtained from this toy play measure. First, the measure can be scored on the number of different schemes or behaviors the infant exhibits toward the toys, giving us an idea of the infant's range of behaviors. Secondly, a ratio can be derived based on:

$\frac{\text{number of specific exploratory schemes}}{\text{total number of schemes}}$, giving us an indication of the infant's level of exploratory behavior. Third, by comparing the infant's reactions toward novel toys versus toys previously played with, we can obtain a measure of the infant's interest in novel stimuli. Recent evidence suggests that interest in novelty may be one of the critical markers for early cognitive development. Fourth, by giving the infant certain toys that require the infant to interact with the toy to get a response, we can obtain a measure of the infant's persistence in attempting to obtain reactions from its environment. Finally, a measure of the infant's attention span can be obtained through recording the duration of time the infant plays with each object. The specific toys used will differ across ages and cultural settings, but the same specific dimensions will be scored across all projects. Toy play measures will be obtained at 6, 9, 12, 15, 18, 21 and 24 months during the cognitive testing sessions.

C. Language Probe. At present there is little evidence on the impact of chronic mild malnutrition and its correlates upon language development. At 24 months, a 5-minute audiotape of the child's language level will be made while the mother is teaching the child a simple task. These tapes will be scored on dimensions such a mean length of utterance, number of different words used by the child, and complexity of the child's grammatical structure. To aid in interpretation of these language measures, it was strongly recommended that a hearing screen also be given at 2 years of age as a means of assessing if there is any major hearing loss by the target children (it would also be desirable if some type of vision screening could also be instituted at the same time).

Instruments: Measurement of Parent-Child Interaction and Temperament

A. Interactional-Environmental Measures. As noted earlier, previous research has suggested the critical importance of child-caretaker interaction patterns,

both in terms of their being influenced by chronic mild malnutrition of the child or caretaker and in terms of their interacting with chronic, mild malnutrition to effect cognitive outcome. However, the specific environmental factors that influence and are influenced by chronic, mild malnutrition have not yet been clearly delineated. In the present section we describe measures of the infant's social and physical environment that will be obtained between birth and 24 months. For interactional measures our TAG recommended a monthly observational cycle. Given the limited sample size we feel it is essential to obtain repeated monthly observations to maximize the stability and representativeness of this data source.

Evidence on home environmental factors will be obtained by field personnel who will be trained in obtaining time sample data on specific environmental dimentions. These observations would be done monthly while the observer was making regular visits to the infant's home. Specifically, it was proposed that during the week each month a given family is seen, one hour of observational data be collected for each infant in the household. These data should be collected at different times in the day over a period of several days rather than in a single observation. Interaction items to be coded include: number of people in the home, number of toys or household objects in the home within the child's reach, the amount of physical contact between the target child and any other member of the family, the number of vocalizations directed at the child by any family member and the type of response made to the target child's vocalizations or distress calls by any family member. These measures, besides having demonstrated relevance to cognitive development in nourished populations, are easily observed and identified and can be coded with pencil and paper and a stopwatch.

In addition to the above measures, during the one month Brazelton exam as well as during the 3, 6 and 9 month cognitive exams, a measure of infant-caretaker face-to-face interaction will be rated, scoring for degree of nonverbal commu-

nication and emotional expressiveness between caretaker and infant. In addition, at 24 months, caretaker language level will be assessed and coded during the cognitive testing session by having the caretaker attempt to teach the child to solve a simple task.

B. Infant Temperament. In the search for individual difference parameters which may mediate both impact of stress upon the child and the nature of the child-caretaker relationship, one dimension that has received increasing prominence is the temperament of the child. In the present project children's temperament will be assessed by examiner ratings following each cognitive testing, utilizing the Bayley Infant Behavior Record from 3 to 24 months. The Infant Behavior Record rates children's characteristic styles during testing on a variety of dimensions including responsiveness to persons, cooperativeness, fearfulness, goal directiveness and attention span.

Procedures

As noted earlier, during the one week per month each household is being seen, one hour of caretaker-infant interaction should be coded. Observation time should total one hour per month, but the observations should take place over a period of several days at different times of the day and evening to ensure generalizability of results. Ideally observers would be trained primarily in observational techniques. However, if budgetary restraints make it impossible to have personnel just doing observations, there is no reason why these observations could not be done while a field worker was also getting other types of data, such as evidence on morbidity.

For the more structured testing, involving both cognitive and behavioral parameters, the use of testing in the home was not recommended due to the possibility of interference from other family members and crowded disorganized conditions in the homes themselves. What was recommended instead was a "home-like" testing site to be set up in the target children's villages at a point that is distant

enough from where the majority of children reside to avoid interference, but not far enough away to lead to transportation problems. This could involve either modification of space in a clinic/hospital or renting several rooms.

As noted earlier, cognitive behavioral testing will take place (with the exception of activity measure) at 1, 3, 6, 9, 12, 15, 18, 21 and 24 months. For cognitive testing at 1, 3, 6 and 9 months about one hour of testing time per infant will be needed. For infants at and above 12 months, it is estimated that cognitive behavioral testing would take about two hours. Based on the limited endurance of infants, it is strongly recommended that this two hours be spread over several days to avoid the problem of infant fatigue leading to incorrect results. This testing would take place during the week a particular family was being seen.

It was very strongly recommended that field personnel responsible for cognitive, behavioral assessment and observational measures should be native born individuals, who are familiar with the ecology and customs of villages we will be utilizing as target populations. Specifically, the most appropriate personnel for cognitive testing would be students in pediatrics, education, behavioral sciences, nursing and/or community health workers who are familiar with infants and infant assessment. Personnel without some experience with infants and behavioral assessment should not be used for this type of data collection.

Further, to avoid contamination of results personnel who do cognitive/observational assessments should not be those who are taking measurements (such as nutritional status) which would be used as predictors of cognitive performance.

In terms of training, it is recommended that the field coordinator be made familiar with all cognitive and interactional measurements that are utilized. Then the field coordinator and the senior investigator would jointly train the field personnel in the various procedures utilized. The field coordinator would then be responsible for maintaining testing and reliability standards.

In all cases, individuals will not be allowed to begin actual data collection until they have registered a set level of interrater reliability with either the senior investigator or the field coordinator. Further, it is recommended that the training of all workers include the rationale of the work and the need for following procedures scrupulously; otherwise individual testing and observational styles will eliminate the utility of many of the measures we are proposing. Again, the need for periodic (every 6 months) recalibration and restandardization of all field personnel on all measures is strongly recommended.

Statistics

In addition to the specific predictor and criterion measures noted previously we anticipate relating the following measures, obtained from other CSSP sections to cognitive outcome. These will include the following: (1) measures of maternal nutritional status during pregnancy; (2) measures of infant nutritional status at birth (perhaps through anthropometric measures such as the Ponderal Index; (3) measures of infant nutritional status during the first two years of life including both general nutritional status and status in regard to specific nutritional indices such as iron deficiency; (4) measures of infant morbidity status during the first two years of life. Out TAG strongly emphasized the point that it will be critical to obtain comparable data at the same points in time for the same data sets.

Given the fact that we are looking at multivariate predictor and outcome measures at different ages, it would seem important to utilize statistical measures that allow us to reap the maximum benefits from our data. Although we realize that specification of statistics is the responsibility of another TAG, our group felt it important to suggest several potential approaches which would

be congruent with the types of questions that the cognitive group has raised. Specifically, when we are asking a question of what variables influence outcome, multivariate measures such as canonical correlation seem appropriate to deal with the question of what predictor sets (i.e., mother and infant nutritional status, disease history, parent-child interaction) maximally correlate with various criterion sets (i.e., attention, verbal behavior, persistence). Similarly, in terms of development of a risk index, at a given age infants could be divided into specific groups; those who are cognitively normal, those who had global deficits, and those who had deficits in one or more specific cognitive skills. k group multiple discriminant analysis could then be used to determine which biological and psychological parameters measured at different ages maximally discriminated between the different groups. It is recognized that by focusing primarily on newborns we will have a very limited sample size. Obviously a small sample size limits the utility of multivariate statistics and the generalizability of findings when multivariate statistics are used. Ideally, if some of our early predictors prove to be nonsignificant or significant only in a time limited sense, it would be possible to then integrate the data from the secondary target group of older sibs (who would not have these earlier measures) with the data from our primary group to thus increase sample size. Even with a limited sample size it must be stressed that, given the complexity of the problem, we do not feel that simple univariate statistical approaches will reflect the synergistic complexities involved in understanding the impact of chronic mild malnutrition and its correlates.

Information Required From or Requested by Other Areas of the Project

As described earlier, our main focus will be on the newborn infant and its sibs below 24 months of age. However, if specifically requested by other areas we are willing to provide information on cognitive performance on older sibs and

adults as needed. As we have noted, given the stability in cognitive performance for these groups and the two year limitation on data collection, a single test battery given at a specific point in time would be our recommended course of action (one possible exception might be the aged where a battery repeated after two years might yield sufficient variability). Again, as with the infancy tests, our focus will be on the measurement of specific cognitive processes. Specifically we would recommend the following battery if testing is requested for children or adults:

1) Porteus Maze Test - A measure of planning and foresight;

2) Wechsler Performance Scales - Scoring individual subtests on dimensions of fluid intelligence (short-term memory, visual motor organization, nonverbal concept formation);

3) Wechsler Vocabulary Subscale (Revised for appropriate country) - A measure of crystalled intelligence;

4) Wechsler Digit Span (Forwards - backwards) - a measure of short-term memory;

5) Story recall (Wechsler memory scale - using culturally appropriate stories) Scoring both for literall recall and recall of story themes - a measure of long term memory;

6) Continuous Performance Task - A measure of attention and reaction time where the subject is required to identify specific, culturally appropriate pictures as they appear on a screen.

To aid interpretation of our observational data, we would expect to utilize data gathered by other areas. These could include the following:

1) Social competence may wish to provide us with anthropological data on the specific home and family variables which characterize a particular culture, particularly those involving child-rearing patterns. Such data as family routine and household structure would be invaluable in this regard. In addition, other data such as the degree of modernization and its impact, and sources of protein and diet patterns would also be useful. This data would help us in terms of interpreting the meaning of various patterns of child-parent interaction observed during our home and caretaker-child interaction sessions. If cognitive testing on older sibs is requested, data of school performance of these children,

where available would also be useful.

2) Along the same lines, data from work output, sampling specific child care activities in such areas as health, feeding and psychosocial functioning would be invaluable, in terms of looking at the impact of a new member of the household upon reallocation of caretaker time and patterns of primary caregiving. This data would be especially valuable it if could be obtained prior to the birth of a target child. Such evidence will be critical in terms of determining what are culturally appropriate patterns and how these lead to different outcomes, both within and across cultures.

3) If repeated testing on the aged is requested demographic data on life span in each country would be invaluable in helping us define this population.

Coding

Given the nature of our data, for the overwhelming majority of parameters, coding could be done in the field. This is particularly true for various types of observational and parent-child interactional measures. For cognitive and behavioral measures it is recommended that coding be done in a laboratory setting either in the field or back in the United States. Once obtained, data should be sent not only to a central data bank, but also to each senior investigator to allow them to begin preliminary analytic work.

Interproject Standardization

In regard to interproject standardization, the committee felt that the cognitive area faced a problem that may be less relevant for more biological areas such as nutrition or pregnancy/lactation. Specifically, modifications in many of the variables we hope to measure will have to be done to fit the measures to the cultural patterns of a specific country. It is possible, however, to modify instruments and still be measuring the same basic processes. Therefore it was strongly recommended that, following the integrative report of the Scientific

Coordination Board, each of the senior investigators in the cognitive area visit their specific country to observe the ecology and conditions of the villages they will be working in, determine the availability of instruments standardized for use in each of the particular cultures, and, if at all possible, begin some pilot testing to assess the difficulties and problems with the instruments we have suggested. Following this first in-country trip, it was then recommended that each of the senior investigators meet at a single site to discuss what modifications in instruments would be necessary. At that point it could be determined whether the degree of modification required will affect the assessment of the specific processes that we are interested in. Along this line it again must be stressed that we are interested more in the measurement of specific process dimensions than in utilizing a specific test. Therefore, the question that must be central to this proposed meeting is the degree to which modifications demanded by each unique culture will alter measurement of processes, rather than a degree to which alterations in tests must be made.

18

Report of the

Technical Advisory Group on Social Competence

April 18, 19, 1982

New Orleans, Louisiana

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SOCIAL PERFORMANCE

Executive Summary

Two factors, TIME and TRANSACTION, will be used to measure and operationalize the variable, Social Performance.

The major data category for observing and evaluating Social Performance is Activity. ACTIVITY will be observed as distinct behavioral acts which are directly or indirectly production-related, and which take place in the home or home environment, or away from the home environment. School-based Activity will also be observed and measured.

The household is the level of analysis. Units of analysis are Individuals and Households. The community will be studied indirectly, basically as a resource to the respondent households.

Data will be obtained longitudinally, beginning with a standardized baseline. The data will include Time - Activity measures, Transaction - Activity measures, and measures of household food energy. Repeated measures will be obtained at specified times during "challenge-free" and "challenge" periods.

Social Performance may be determined from a summation of outcomes re. levels of household food energy, Time - Activity measures, and Transaction - Activity measures.

All measures and procedures will be context-sensitive. Measures and procedures will also be similar across country projects. Therefore, "project equivalents" will be developed and tested prior to implementation. Ethnographic reconnaissance studies are indispensable here.

30

TABLE OF CONTENTS

	Page
I. Introduction	1
Social Competence as a Dependent Variable	2
TAG Working Principles	2
Social Competence vs Social Performance	3
II. Social Performance	4
Conceptualizing Social Performance	4
Operationalizing and Measuring Social Performance	4
Research Considerations	5
Level of Analysis: The Household	5
The Household Defined	6
Major Research Concerns at the Household Level	6
Units of Analysis: Individual, Household, Community	7
Data Categories for Determining Social Performance	8
Behavioral Acts associated with the Data Category, Activity	9
Behavioral Acts associated with the Data Category, School Performance	10
Research Questions to be Addressed	10
III. Ethnographic Considerations	11
Standards of Behavior	12
Household Subsistence	12

		Page
IV.	Data Collection and Evaluation	13
	Suggestions and Recommendations on Data Collection	13
	Suggestions and Recommendations on Evaluation	15
V.	Summary	17
VI.	Reference Cited	18
VII.	Appendices	
	Appendix 1 Some Questions for Discussion	20
	Appendix 2 Statements on Social Competence/ Social Functioning	22
	Appendix 3 References	25
	Appendix 4 Production-Related Behavioral Acts - Direct	29
	Appendix 5 Production-Related Behavioral Acts - Indirect	36
	Appendix 6 School-Related Behavioral Acts	42
	Appendix 7 Milestones and Life Events	44
	Appendix 8 Selected Ethnographic Data Categories	47

I. INTRODUCTION

The Nutrition CRSP Technical Advisory Group on Social Competence met in New Orleans, Louisiana on April 18-19, 1982 to present, discuss, and evaluate concepts and methodological approaches for measuring social competence in the core research design on food intake and function. The specific objectives of this meeting were to:

1) reach consensus on the concept, social competence, as it pertains to the food intake and function study;
2) define relevant research questions to be addressed in the preliminary survey in Phase I;
3) develop, in a preliminary way, effective mechanisms for obtaining accurate, reliable, quantitative data to answer the research questions.

The TAG chairman provided some basic materials to facilitate group discussion: (1) a list of questions (Appendix 1); (2) statements on social competence obtained from reviewing the literature (Appendix 2); and (3) a selected reference list on social competence (Appendix 3). In addition, each TAG member was sent a copy of the document entitled "Report of the Workshop on Malnutrition and Social Funtion," Appendix II-3 of the Nutrition CRSP grant proposal, by the management Entity (ME) approximately one month prior to the meeting.

Social Competence as a Dependent Variable

TAG members recognized the importance of social competence as a specific dependent variable in the food intake and function multi-country study, but stressed the need to integrate it with the other four dependent variables. In fact, the five dependent variables are highly interdependent as they interweave in contributing to individual and household food energy supply.

Social competence is the thread integrating the other functional elements. It defines the capacities (and limitations) of people as they perform their daily, routine tasks. It captures their problem-solving abilities, management skills and adaptational responses as they encounter new and recurring challenges. Moreover, it can depict the diversities in human response to fairly uniform social-environmental conditions. Appropriately conceptualized and applied, measures of social competence could help explain why individuals and households are more or less successful in acquiring adequate food energy, although all live under similar social and environmental conditions.

TAG Working Principles

TAG members emphasized the need to establish some basic "working principles" for their work. These include:

- clear conceptualization on the construct, social competence
- careful operationalization of the concept
- well-defined, multi-levelled units of analysis with connecting links

- naturalistic behavioral measures
- measurement strategies applicable to field settings
- measures of household subsistence that can be standardized, to permit comparisons within and across countries
- culture-sensitive research instruments and procedures
- a research approach that captures change, or ongoing interaction between person and environment, to permit generalization over time
- an ethnographic data base (current) as primary resource for finalizing methodological approaches and research procedures
- competency measures that can be quantified

The members recognized that strict adherence to some of these "working principles" could result in dissimilar research procedures across country projects. For example, research instruments and procedures that are sensitive to the Mexican field setting might not fit Egypt's or Kenya's. Ideally, research procedures should be identical across country projects. However, we expect that the ethnographic database from the three research settings would generate "project equivalents" in order to measure similar entities across projects. As a simple example, in assessing specific tasks, it is important to determine whether corn husking by the Mexican and Kenyan worker is "equivalent" to wheat threshing by the Egyptian. Developing "project equivalents" for implenting Phase II should be accorded high priority.

Social Competence vs Social Performance

Since action behavior is fundamental to our concerns, and production-related behavior is key to food energy supply, we agreed to adopt the term social performance for purposes of this research. We propose that "social performance" replace the term "social competence."

II. SOCIAL PERFORMANCE

Conceptualizing Social Performance

Like Wrubel, Benner and Lazarus (1981) on social competence, we view social performance from a transactional perspective and also recognize its multi-dimensional features such as process, style and outcome. Thus, for our purposes, social performance refers to human behavioral acts which derive from the mutual influence of the person and the environment in specific encounters and settings, to effect household food energy supply. Since the relationship between the person and the environment "is dynamic and in constant change as the transaction proceeds, observation and documentation of these changes across time and across situations must precede an overall evaluation" (Ibid p. 65). Also, since production-related behavior is a major concern, time involved in the encounter must also be observed and recorded. Quality of time can be determined indirectly from the transaction itself and from the outcome, food energy supply.

Operationalizing and Measuring Social Performance

TIME AND TRANSACTION were considered basic factors in operationalizing and measuring social performance in production-related behavior.

TIME - the amount and proportion of time spent performing production-related acts - direct and indirect - at home base, and in environments away from home.

TRANSACTION - modes of social functioning in relation to production-related activities that effect household food energy supply. (Observations on encounter modes, management styles, decision-making, scheduling, and other aspects of social functioning can be quantified.)

Both elements, TIME and TRANSACTION, can be quantified. Moreover, both elements fit the requirements of a longitudinal research design. Most importantly, perhaps, when combined, they help to determine how people manage their daily, routine tasks, how they adjust to new and recurring challenges, and how long it takes to recover from such periodic onslaughts.

Research Considerations

1. Level of Analysis: The Household

The level of analysis is the household. The household is the key to the comparability among the three countries. The factors involved in household subsistence (e.g. household composition, land holdings, labor availability, etc.) are clearly more generalizable across countries than are individual roles. Household food energy supply may also be more generalizable across countries than the energy intake of individuals. If so, levels of food energy supply may well be an important index of social performance.

b. The Household Defined

One definition of household/homestead[1] might be a unit of aggregation which consists of individuals who regularly contribute to its food energy supply and consume from that supply, regularly or irregularly. The individual members may or may not live under the same roof continuously.

This provisional definition of the household accounts for the absent (often commuting) male, a common practice in many communities. It also accounts for Kenyan residential and mating patterns, and the diverse nocturnal patterns of children, adolescents and males in many rural (and urban) communities.

c. Major Research Concerns at the Household Level

Three major research concerns pertaining to social performance can be addressed at the household level across countries, even in light of cultural variation: (1) the amount of time (and energy[2]), and the proportion of time spent by household members in direct and indirect production-related activities to yield adequate levels of household food energy, (2) the style, process, and outcome of transactions between (or among) household members as they engage in direct and indirect production-related activities; (3) the impact of challenge events (crisis, emergency, stress-in "project equivalent" terms) on levels of household food energy.

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[1]To account for variation in the Kenyan situation.

[2]Work performance TAG

d. Units of Analysis: Individual, Household, Community.

TAG members re mended that three units of analysis be considered:

1. The Individual
   - school-age child, male and female, between 6 and 12 years of age
   - lead female of reproductive age
   - lead male, spouse or mate of lead female

Observation and collection of data in the other four functional areas (reproduction, activity, disease, cognition) is being performed at the level of the individual. For the purpose of continuity and integration of the dependent variables, data collection of social performance will also focus on the individual and interaction between and among individuals in the household context, considered within the framework of the community. Thus, links between the individual, household, and community are recognized and affirmed.

2. The Household
   - as a social group transacting, as skills are taught, tasks assigned, labor contracted, games played, etc. as people engage in direct and indirect production-related activities
3. The Community
   - to be studied indirectly in its role as provider (or non-provider) of resources to individuals and households

The community can both help and hinder the individual and household by providing or withholding the resources necessary for appropriate social functioning. To reiterate, we view the individual as functioning within the household context in the framework of the community, and, of course, the society.

e. Data Categories for Determining Social Performance

The TAG identified ACTIVITY as the major data category for recording information on adults and children. A second category, SCHOOL PERFORMANCE, will determine performance levels of children in the context of school.

Specific behavioral acts[3] can be derived from the two data categories. These can then be used for evaluating the social performance of individuals and households. The factors, Time and Transaction must be applied to complete the evaluation.

An Example: If we were to measure Time expenditure (or Time allocation) for representative behavioral acts of a household (consisting of lead male, lead female, and three school-age children) during well-chosen blocks of time in a specific season and temporal cycle (e.g. a 24 hour day), we could determine Time - Activity modes for each person. Time - Activity measures could be obtained for the initial or baseline period and for "normal" periods i.e. when the household situation is stable. Modes of Transaction and levels of household food energy should be obtained when Time - Activity measures are taken. Through repeated measures on Time - Activity modes, Transactional modes, and levels of household food energy during "challenge"[4] and "challenge-free" or "normal" periods, we should be able to evaluate social performance. In this case, social

[3]Examples of behavioral acts are presented in Appendices 4, 5, and 6.
[4]Examples of "challenge events" are presented in Appendix 7.

performance is defined as the household's ability to either maintain or increase its baseline food energy level. In our view, challenge response is crucial to evaluating social performance.

f. Behavioral Acts associated with the Data Category, Activity

As mentioned earlier in this report, the TAG suggested that naturally occurring behaviors be identified and measured to determine Social Performance. One way to accomplish this is to observe and measure individuals as they "perform" naturally at work, at school, at play, at rest - under "normal" or "challenge-free" conditions, but, also, as they "perform" in response to challenges that occur periodically.

Since production-related activities are viewed as "observational units" we classified individual behaviors into categories of acts which are (i) directly production-related, or (ii) indirectly production-related. These two categories were further subdivided into acts performed (i) in the home or home environment or (ii) away from home or home environment. Further, since the research project is largely concerned with various aspects of food production and use, activities involving food were separated from other activities.

1. Production-related Activities - Direct:

   Acts performed by members of households/homesteads which, in function, contribute directly to the household/homestead food energy supply. (Refer to Appendices 4A and 4B for details).

2. Production-related Activities - Indirect:
   Acts performed by members of households/ homesteads which, in function, contribute indirectly or incidentally to the household/ homestead food energy supply. (Refer to Appendices 5A and 5B for details)

   g. Behavioral Acts associated with the Data Category, School Performance

School Performance (of children 6-12 years of age):
Acts performed by the school child in the context of schooling which can be evaluated by the child's teacher(s). (Refer to Appendix 6 for details).

Research Questions to be Addressed at the Household Level

Is there a relationship:

1. between the amount of time spent by households in direct production-related activities and level of household food energy supply?
2. between the proportion of time spent by households in direct and indirect production-related activities and level of household food energy supply?
3. between household transaction mode in conducting direct production-related activities and level of household food energy supply?

4. between household transaction mode in conducting indirect production-related activities and level of household food energy supply?
5. between level of school performance and level of household food energy supply?
6. Are there relationships between levels of household food energy, number of challenge events, type of challenge experienced by household, and stage of recovery from the challenge event?

III. ETHNOGRAPHIC CONSIDERATIONS

TAG members suggested that data obtained from the ethnographic research in Phase I should expand, reduce, or otherwise modify the behavioral categories presented in Appendices 4, 5 and 6. The ethnographic data should also aid in determining appropriate modes of transaction, management strategies, person-environment encounters, observational settings, and options (or scale dimensions) for assessing problem solving skills.

Although our TAG strongly agrees that social performance can be rigorously defined and operationalized in the three research sites, the group also feels that maximum effectiveness and credibility of this concept will be achieved only if we have pilot ethnographic reconnaissance in the three sites, in order to identify

the best possible indicators of performance , i.e. indicators which will be context sensitive, clearly quantifiable, and comparable across the three sites.

Standards of Behavior

Ethnography will define two sets of standards of behavior: local standards and official standards. Local standards are the patterns of acceptable and unacceptable behavior which are defined at the community level by people in the community. Official standards are doctrines of institutions and may be contrary to local standards. This is especially true in the case of school attendance.

Household Subsistence

The ethnography and description of each household will furnish us with adequate baseline data on the subsistence resources of the households to be studied. The key data required, at a minimum, include the major capital resources of land, animals, equipment and water/fuel access. Several other categories may also be important in a particular site.

Content areas for measuring subsistence is presented in Appendix 8. These should be measured quite comprehensively once, and then updated, selectively, during the course of the study.

IV. DATA COLLECTION AND EVALUATION

Suggestions and Recommendations on Data Collection

A list of recommendations for data collection is presented below:

1. Twenty-four hour Time/Transaction tables for each respondent, to record (i) Time - Activity data i.e. the number of hours the respondent spends in direct and indirect production-related activities (Appendix 4A, 4B, 5A and 5B) (ii) Transaction[5]- Activity data i.e. descriptions of transaction modes associated with the various activities. Includes range of appropriate options available to respondent, options used, individuals involved in decision-making process, scheduling, time juggling, and other "process" data.
2. For each act recorded in the table, Time will also be recorded in terms of (i) absolute time for each 24-hour period, (ii) average time (for 4 rounds in the Sampling period), (iii) percent time, and (iv) proportion of time spent in direct and indirect production-related acts.
3. For each act recorded in the table, mode of Transaction will also be recorded. These will be based on criteria which will be developed further.

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[5] Descriptors must first be developed within the context of each field setting. Later, we can derive "project equivalent" descriptors.

4. A child's Time - Activity data might be evaluated as a "productive time input coefficient." This would assess the child's productive work hours as a proportion of the adult work hours.
5. To get the most valid and reliable association between household food energy supply and social performance, data for evaluating social performance should be collected and standardized after a series of food observations.
6. Behavioral acts selected for study should be common across research sites. "Project equivalence" should be determined from the ethnographic data.
7. To effectively measure response to challenges, include only challenge events[5] that are economically-related e.g. loss of an economically-productive adolescent male, and not emotional crises e.g. loss of a newborn son. (The author disagrees with this caveat).
8. Response to challenge data should be collected at different stages, periodically, in order to measure adjustments to challenges that are both predictable and non-predictable.

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[5]Refer to Appendix 7

Suggestions and Recommendations on Evaluation

The Social Performance of households can be determined from a summation of outcomes. Levels of household food energy supply during "challenge-free" and "challenge" periods appear to be most relevant. Levels of household food energy supply could also serve as (i) indices of recovery from stress following a challenge (ii) degree of vulnerability (iii) indices of adjustment to change.

Social performance may also be determined from the household's ability to maintain essential activities. This could be evaluated by (i) number and percentage of activities maintained (ii) labor values of the activities or by both (i) and (ii).

The Social performance of individual household members should also be evaluated. Individual Time - Activity and Transaction - Activity tables can be used for this purpose if roles and goals are specified. Where relevant, self-assessment scales should be developed, tested and used with individual respondents. Examples are (i) a self-anchoring scale with locally relevant end points or (ii) a graded (perhaps 5 points) "success" or "effectiveness" scale to rate success or effectiveness in achieving specific goals.

The degree to which household resources, or the resources of other households and the larger community are employed in reducing stress and solving problems should be included in any comprehensive evaluation of social performance. Some examples of household coping

behaviors or responses to challenge that threaten subsistence include:

- downward shift in food consumption
- diversification of production
- expansion of production
- increase or decrease in borrowing, lending, pawning, etc.
- increase in exchange transactions
- shifts in labor allocation
- reallocation of roles
- shifts in household power structure
- increased legal proceedings

V. SUMMARY

Two factors, TIME and TRANSACTION, will be used to measure and operationalize the variable, Social Performance.

The major data category for observing and evaluating Social Performance is Activity. ACTIVITY will be observed as distinct behavioral acts which are directly or indirectly production-related, and which take place in the home or home environment, or away from the home environment. School-based Activity will also be observed and measured.

The household is the level of analysis. Units of analysis are Individuals and Households. The community will be studied indirectly, basically as a resource to the respondent households.

Data will be obtained longitudinally, beginning with a standardized baseline. The data will include Time - Activity measures, Transaction - Activity measures, and measures of household food energy. Repeated measures will be obtained at specified times during "challenge-free" and "challenge" periods.

Social Performance may be determined from a summation of outcomes re. levels of household food energy, Time - Activity measures, and Transaction - Activity measures.

All measures and procedures will be context-sensitive. Measures and procedures will also be similar across country projects. Therefore, "project equivalents" will be developed and tested prior to implementation. Ethnographic reconnaisance studies are indispensable here.

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VII. APPENDICES

APPENDIX 1

Some Questions for Discussion

1. To arrive at a functional definition of Social Competence should we first specify the level of analysis.

   Is it the community?

   Household?

   Individual?

2. Could it be all three or two of these?

3. What standards should be employed to judge competence?

4. Assuming that the target community sets its own standards of social competence, specifically, what information, and how much is needed from the ethnography to establish local standards of social competence?

5. To what extent should "official standards" (e.g. regulations about schooling, immunizations, etc.) be used in the formulation?

6. How do we reconcile differential local (and official) standards of social competence in the three research communities?

7. Competence in what? For what?
   Assuming prior specification of the level of analysis, is it feasible to develop a fully integrated project by determining social competence in

   -- farm management
   -- food production
   -- harvesting
   -- food acquisition
   -- animal care
   -- infant feeding
   -- family health care
   -- fertility management
   -- child care
   -- menu planning
   -- household management
   -- general resource management
   -- food preservation
   -- food storage
   -- intra-household food distribution
   -- food purchasing
   -- food intake
   etc.?

8. How do we operationalize the concept and units of analysis to obtain outcome measures and quantitative data? For example, if appropriate trade-offs in certain circumstances are considered competent behavior, how do we measure it?

A major challenge is to assess "adaptive competent behavior" i.e. to determine competence of the individual in relation to his or her environment, and sociocultural situation. To meet the challenge, the behavior must first be defined contextually i.e. the social/environmental context must be defined. Secondly, the demands for appropriate behavior in that social/environmental context must be spelled out. Also, the constraints and resource must be specified. The measure, then, should include a set of options (opportunities for trade-off) open to that particular individual in that particular socio-environmental context.

APPENDIX 2

STATEMENTS ON SOCIAL COMPETENCE/SOCIAL FUNCTIONING

1. "The term 'social functioning' encompasses a broad range of individual and group behaviors. It is not a specific variable, but many variables which reflect how individuals perform in their social and cultural environments, how they act on the environment in which they live, and how they act on one another. No matter whether the focus of research is reproductive competence, response to disease, work production, school performance, or cognitive functioning, the behaving individual, alone and as part of groups and social institutions, is an ultimate concern.

   For this purpose, the working definition of social functioning includes behaviors involving responsiveness to stimulation, change, and stress, capacities to adapt to complex environmental demands, and skills used in interpersonal relations in the many and diverse roles in which the individual operates. Social functioning ranges from interactions between the individual and family to interactions between family and community including institutions." (Report of the Workshop on Malnutrition and Social Competence, 1978, p. 1).

2. "Social competence is the ability to meet effectively all responsibilities appropriate for one's societal status." (Ellen Messer, 1978, p. 13).

3. "Competence .. develops along three major axes, all closely interrelated. First is the ability to learn or to use a variety of alternative pathways or behavioral responses in order to reach a given goal ... Second, the competent individual comprehends and is able to use a variety of social systems within the society, moving within these systems and utilizing the resources they offer. Third, competence depends upon effective reality testing. Reality testing involves not merely the lack of psychopathological impairment to perception but also a positive, broad, and sophisticated understanding of the world." (T. Gladwin, 1967, p. 32).

4. "The degree to which an individual is able to identify, secure and utilize personal and environmental resources in order to initiate action for achieving positive outcomes, and/or to respond appropriately to ongoing and social/environmental insults. In other words, successful adaptation to challenges of personal, family, community and societal life." (Norge W. Jerome, Nutrition CRSP proposal).

5. "Personal characteristics (knowledge, skills and attitudes) which lead to achievements having adaptive payoffs in significant environments (requires the assessment of the motive of the person and the demands and resources of the environment. Competence suggests an ecological situation." (Norman D. Sundberg et al, 1978, p. 196).

6. "The combination of skills, attitudes and motivations which enable the individual to operate effectively within the environment." (Marvin B. Sussman, 1979, p. 256).

7. "Competence involves effective role performance for self and for society." (M. Brewster Smith, 1968, p. 27[illegible]).

8. "Social competence refers to the ability of people to fulfill needed social roles at a given point in time." (Sigmund E. Dragastin, 1970, p. 280).

9. "Interpersonal competence is a skill or ability 'in controlling the outcome of episodes of interaction' (p. 36) comprising six components: health, intelligence, empathy, autonomy, judgement and creativity." (N.N. Foote and L.S. Cottrell, 1955).

10. "The ability to attain and perform in three sets of statuses: those in which one's society will normally assign one, those in the repetoire of one's social system that one may reasonably aspire to, and those which one might reasonably invent or elaborate for oneself." (A. Inkeles, 1966).

11. "Competence means effective performance in one's social role." (Philburn Ratoosh, 1978, p. 2).

12. "Competence is a set of functional or instrumental skills which make it possible to perform a culturally specified task." (John Ogbu, 1981, p. 414).

13. "Competence is more than successfully competing, or utilizing one's capacities effectively, or being able to change adaptively to new circumstances or deepening one's knowledge of self. The missing ingredient is how well we persist with the effort to deepen our understanding of the fact that we are embedded in and are expressions of a near and distant social world... understanding what one does, thinks, and concludes always reflects embeddedness in a near and distant social world." (Seymour B. Sarason, 1980, p. 25).

14. "In general, the objective of socialization is to produce competent people, as competence is defined in any given society. It aims to develop a person who can take care of himself, support others, conceive and raise children, hunt boar or grow vegetables, vote, fill out an application form, drive an auto, and what have you." (A. Inkeles, 1966, p. 265).

APPENDIX 3

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APPENDIX 4 - A

PRODUCTION-RELATED BEHAVIORAL ACTS - DIRECT

A. Based at Home or in Home Environment[1]

1. Cultivating plants:

   e.g. plowing
   sowing
   irrigating
   weeding
   fertilizing

2. Cultivating animals:

   e.g. washing
   grooming
   feeding
   watering
   shearing

3. Acquiring food for household consumption:

   e.g. harvesting
   milking cows, goats, etc.
   slaughtering animals
   collecting eggs
   hunting game (large and small wild animals)

4. Acquiring food for selling or bartering:

   e.g. same as 3 above

5. Preparations for obtaining household food supply:

   e.g. surveying household food supply
   making up shopping list
   preparing fishing bait, tackle, etc.
   sharpening knives, machetes, etc.
   preparing fishing nets
   preparing plough, etc.

6. Preparing items for securing food for sale or barter:

   e.g. same as 5 above

---

[1]Refers to property owned, rented, leased or otherwise titled to household. Environment is not limited to immediate home vicinity.

7. Producing goods in the household <u>for sale</u>:

   e.g. weaving baskets
   making wearing apparel (shawls, shoes, socks, shirts, pants, underwear, dresses, hats, etc.)
   making cottage crafts
   making furniture
   making wooden tools, utensils
   making pottery utensils

8. Producing goods in the household <u>for household use</u>:

   e.g. same as 7 above

9. Wage-earning activity (contract work, non-speculative):

   e.g. embroidering
   sewing

10. Marketing food and food products produced in household:

    e.g. pricing
    making labels
    labeling
    packaging
    making signs
    dividing product into unit amounts for sale.

11. Marketing non-food items produced in household:

    e.g. same as 10 above.

12. Loading baskets for transport of household-produced items to market.

13. Unloading packages and putting away items:

    e.g. household-made and produced food and products not sold or bartered at market
    purchased products for household use

14. Bartering food and food products produced in household at home-base:

    e.g. discussing product(s) with potential buyer
    bargaining on value
    dividing product
    exchanging product-for-product, or promise of product, or product-for-service or promise of service.

15. Bartering non-food items produced in household at home-base:

    e.g. same as 14 above.

16. Selling food and food products produced in household at home-base:

    e.g. discussing product(s) with potential buyer
    dividing product
    exchanging product for currency
    making change

17. Selling non-food items produced in household at home-base:

    e.g. same as 16

18. Preparing food for further processing - Stage I

    e.g. milling grains
    sealing and cleaning fish
    butchering animals

19. Preparing food for further processing - Stage II:

    e.g. washing
    gathering utensils
    cutting and/or slicing

20. Preserving food:

    e.g. all of 19 plus --
    cooking
    fermenting
    salting
    canning
    drying
    smoking

21. Storing food:

    e.g. putting food in containers
    sealing containers
    labeling containers
    putting containers in storage space

22. Recycling food remains:

    e.g. for animal food
    fertilizer/mulch
    selling
    bartering for other items
    storage for future meal(s)

23. Collecting items:

    e.g. weeds or wild plants (for animal feed or human consumption)
    fertilizer
    fuel (firewood, millet stems, corn husks, dung, sawdust, etc., for food preparation, etc.)
    water

24. Teaching production-related skills:

    e.g. plowing
    preparing fishing nets, tackle
    making furniture
    preserving food
    butchering animals
    preparing meals

25. Post-harvest preparations for future food production:

    e.g. preparing and storing seed
    preparing and storing plantings
    breeding animals

APPENDIX 4 - B

PRODUCTION-RELATED BEHAVIORAL ACTS - DIRECT

B. Based Away-from-Home or Home Environment[1]

1. Wage-earning activity:

   e.g. factory work

2. Preparing food and food products produced in household for sale at market site:

   e.g. unloading baskets
   setting up stand
   arranging products for sale

3. Preparing non-food items produced in household for sale at market site:

   e.g. same as 2 above

4. Bartering food and food products produced in household at the market site:

   e.g. discussing product(s) with potential buyer
   bargaining on value
   dividing product
   exchanging product-for-product or promise of product, or exchanging product-for-service or promise of service

5. Bartering non-food items produced in household at the market site:

   e.g. same as 4 above

6. Selling food and food products produced in household at the market site:

   e.g. discussing product(s) with potential buyer
   dividing product
   exchanging product for currency
   making change

7. Selling non-food items produced in household at the market site:

   e.g. same as 6 above.

---

[1]Refers to property owned, rented, leased or otherwise titled to household. Environment is not limited to immediate home vicinity.

8. Delivering food or food products produced in household in response to a sale, barter, or other agreement

9. Delivering non-food items produced in household in response to a sale, barter or other agreement

10. Delivering services in response to a sale, barter, or other agreement

11. Preparing food or food products produced in household for return from market to home-base:

    e.g. counting money
    taking down stand
    packing up food
    putting food in containers for transport

12. Preparing non-food items produced in household for return from market to home-base:

    e.g same as 11 above

13. Collecting items:

    e.g. weeds or wild plants (for animal feed or human consumption)
    fertilizer
    fuel (firewood, millet stems, corn husks, dung, sawdust, etc., for food preparation, etc.)
    water

14. Acquiring food for household consumption:

    e.g. purchasing at market/stand/shop, etc.
    fishing
    bartering
    hunting

15. Acquiring food for sale or barter:

    e.g. same as 14 above

16. Purchasing supplies for production activities:

    e.g. Utensils for cooking, serving, eating, drinking and storage
    furnishings (chairs, benches, etc.)
    wearing apparel (clothes, shoes, hats, belts, scarves, etc.)
    for food production,(land, animals, seed, fertilizer farming, equipment, etc.)
    for craftwork,(yarn, cloth, clay, wood, metal, etc.)
    for lighting, heating, cooling, supplies,(oil for lamps, lamps, candles, torches, matches, fans, etc.)

17. Participating in communal activities:

    e.g. food co-operative
    equipment co-operative
    farm co-operative
    savings club

18. Participating in community organizations/institutions:

    e.g. agricultural extension programs

19. Traveling for any direct production-related activity:

    e.g. to and from garden or farm
    to and from factory
    to and from market
    to and from well
    to and from river, etc.

20. Waiting for any service or product associated with direct production:

    e.g. water at communal source
    shoeing horse, etc.

APPENDIX 5 - A

PRODUCTION-RELATED BEHAVIORAL ACTS - INDIRECT

A. Based at Home or in Home Environment[1]

*1. Planning the menu (probably a cognitive process which cannot be observed directly; menu planning might be determined indirectly from meal structure).

2. Preparing meals:

e.g. all of Appendix 4(A) 19 plus
combining different foods
adding seasonings
cooking (roasting, toasting, boiling, stewing, baking, frying, parching, etc.)
garnishing
heating/warming

3. Distributing food:

e.g. dividing food
serving portions to others
serving self
helping others who can't serve themselves

4. Consuming food:

e.g. eating
drinking

5. Feeding infant/child

6. Caring for health of household members who are ill:

e.g. preparing home remedies
preparing special diet
seeking medical attention
nursing

*7. Practicing birth control

---

[1]Refers to property owned, rented, leased or otherwise titled to household. Environment is not limited to immediate home vicinity.

*Specific descriptive examples to be added.

*Behavioral acts performed primarily by children between 6 and 12 years of age.

8. Practicing personal hygiene:

   e.g. washing body or part of body
   washing hair
   shaving
   dressing
   putting on cosemetics
   combing hair
   styling hair
   brushing teeth

9. Caring for personal hygiene of other household members:

   e.g. same as 8 above

10. Resting

11. Individual praying, meditating, thinking

*12. Supervising children

*13. Mediating in dispute settlements

14. Entertaining self:

   e.g. dancing
   singing
   playing musical instrument
   listening to music
   listening to radio
   reading

15. Entertaining self (with a few others)

   e.g. playing games (with other adults, e.g. cards)
   playing with children
   dancing
   singing
   playing musical instrument

+16. Playing with other children or adults

17. Washing, rinsing and bleaching (wearing apparel)

18. Washing, rinsing and bleaching (other):

   e.g. rugs, curtains, towels, bedding, etc.

19. Starching (wearing apparel)

20. Starching (other):

   e.g. same as 18 above

21. Drying (wearing apparel)

22. Drying (other)

    e.g. same as 18 above

23. Ironing (wearing apparel)

24. Ironing (other):

    e.g. same as 18 above

25. Storing (wearing apparel)

26. Storing (other):

    e.g. same as 18 above

27. Cleaning and polishing wearing apparel:

    e.g. shoes, buckles, etc.

28. Cleaning:

    e.g. cooking and eating areas (stove, fireside, oven, coalpot, tables, floor, etc.)
    dishes, utensils used in food preparation and consumption

29. Maintaining living quarters:

    e.g. shaking out bedding/rugs
    scrubbing floor
    sweeping
    dusting
    washing walls
    adding oil to lamps
    putting away clothes, toys, dishes, etc.

30. Repairing living quarters:

    e.g. painting
    repairing doors, furniture, fence, etc.
    patching roof

31. Collecting items:

    e.g. cans (for patching roof)
    automobile tires (for patching roof)
    containers (for furnishings)
    papers, magazines, posters (for papering walls, decoration, etc.)

32. Preparing food for a social event/communal activity involving individuals from other households

    e.g. includes some or all behavioral acts included in food preparation in Appendix 4A

33. Preparing living quarters for a social event/communal activity

    e.g. includes some or all of 29 above

34. Participating in activities associated with rites de passages:

    e.g. confirmation
    first communion
    graduation from school
    circumcision

35. Sleeping

APPENDIX 5 - B

PRODUCTION-RELATED BEHAVIORAL ACTS - INDIRECT

B. Based Away-from-Home or Home Environment[1]

1. Consuming food:

   e.g. eating
   drinking

2. Individual praying, meditating, etc.

3. Participating in communal activities:

   e.g. informal gatherings
   social events
   celebrations
   festivals
   contests
   social club events
   choral groups
   sports

4. Participating in community organizations/institutions

   e.g. religious services or functions
   politics
   wakes, funerals

5. Entertaining self:

   e.g. dancing
   singing
   playing musical instrument
   watching T.V.
   listening to music
   listening to radio

6. Entertaining self (with a few others)

   e.g. playing games (with other adults)
   playing with children
   dancing
   singing
   playing a musical insturment

---

[1]Refers to property owned, rented, leased or otherwise titled to household. Environment is not limited to immediate home vicintiy.

*Behavioral acts performed primarily by children between 6 and 12 years of age.

+7. Playing with other children or adults

8. Supervising children

9. Mediating in dispute settlements

10. Leisure travel

11. Commuting travel from urban to rural setting and vice versa

+12. Commuting to and from school

13. Purchasing household items not for use in direct production-related actitivies:

e.g. wearing apparel (clothes, scarves, hats, shoes, shawl, belts, purses, umbrellas, etc.)
personal hygiene (soap, towels, washclothes, toothbrush, comb, etc.)
decoration (jewelry, cosmetics, etc.)
household maintenance/repair (nails, tools, wood, wire, etc.)
musical instruments
radio
books
art supplies (paint, brushes, ink, etc.)
pictures
school supplies (paper, pencils, glue, pens, slate, ruler, etc.)
toys
alcohol, hashish, cigarettes, etc.
religious supplies (candles, prayer beads, etc.)

14. Mutual aid:

e.g. contributing labor to other households
loaning (food, money, animals, etc.) to other households
contributing health care to members of other households

15. Waiting for any service or product associated with indirect production:

e.g. enrolling child in school
medical care

16. Sleeping

APPENDIX 6

SCHOOL-RELATED BEHAVIORAL ACTS
(For evaluating School Performance)

1. Attends school regularly
2. Usually arrives at school punctually
3. Returns home promptly from school
4. Passes most or all subjects at end of term
5. Usually has homework prepared
6. Usually answers teachers' questions correctly
7. Usually seeks assistance with difficult work at school

   e.g. from teachers
   from advanced schoolmates

8. Usually assists teacher with classroom tasks

   e.g. washing blackboard
   getting chalk
   participating in learning demonstration

9. Usually obeys teachers' directions

   e.g. keeps quiet during instruction
   answers questions or speaks up
   takes tests independently

10. Usually works co-operatively with classmates on class projects

    e.g. gives appropriate directions to others
    performs activities directed by others

11. Usually seeks assistance with difficult homework

    e.g. from advanced classmates
    from older brothers or sisters
    from parents

12. Is usually friendly and helpful to classmates
13. Is usually respectful to teacher and others in authority
14. Usually plays well with classmates during playtime

15. Does not usually fight and bully classmates

16. Is usually clean and well-groomed at school

APPENDIX 7

MILESTONES AND LIFE EVENTS

(Preliminary-will change with ethnography and as focus sharpens)

1. Child's graduation from school
2. Marriage of daughter
3. Marriage of son
4. Birth of a healthy son
5. Birth of a healthy daughter
6. Birth of a child with defects
7. Death of a son
8. Death of a daughter
9. Death of a spouse
10. Death of a parent
11. Death of a close relative (grandparent, aunt, uncle, etc.)
12. Death of a local dignitary
13. Changing major source of cash income
14. Loss of major source of cash income (land, shop, job)
15. Starting first job
16. Taking on additional job
17. A major purchase or acquisition

    e.g. purchasing land
    increasing herd
    purchasing an electrical applicance (radio, T.V., etc.)

18. Son or daughter going away to school for first time

19. Son or daughter returning home from school for the first time

20. Passage of child through a life stage ("firsts")

    e.g. baptism
    communion
    confirmation
    fasting (Ramadan, Lent, etc.)
    circumcision

21. Major annual festivals

22. Special Holy Days

23. Return of former local resident from city or other country

24. Severe illness in household

25. Leaving close household member in hospital

26. Severe illness of close relative living in another community

27. Departure of household member for city or other country

28. Arrival of Nutrition CRSP team in community

29. Visit of high local, regional, or national official

30. Major natural disaster in community

    e.g. flood, earthquake, drought

31. Major human-made tragedy in community

    e.g. fire, war

32. Severe shortage of specific food(s)

33. Severe water shortage

34. Severe fuel shortage

35. Introduction of Novelty

    e.g. technological innovation
    new food product
    new crop variety
    new plant species

36. Death of a local, regional or national official

37. Election of local, regional or national officers

38. Departure of Nutrition CRSP team.

APPENDIX 8

SELECTED ETHNOGRAPHIC DATA CATEGORIES

(Draft)

Subsistence Base

1. Household composition, in terms of available personnel: What kinds of persons regularly perform which productive tasks? Including usually expected range of activities tasks of adult family heads, other adult males, adult female heads, elderly persons resident in households of their offspring, and work assignments of children of various ages.
2. Forces of Production
   a. To what extent is there hiring of labor, reciprocal labor exchange and other utilization of, or participation in, inter-household transfers of productive personnel? (Also including in-residing servants, hired hands).
   b. To what extent do family members return home from the city or other locations temporarily to contribute labor to the households?
   c. What are the types of land holdings and forms of ownership of primary cultivation areas, pastures, and other lands, including water resources and fuel supply areas? What other transfers or temporary access to land resources may be important? e.g. rentals, sharecropping, etc.

d. What types of animals are owned and utilized, for traction, fuel, carrying loads, meat, and other uses? What are the ranges of ownership and access that mark the differences from "high resources" to "low resources" in the local economy? Are there patterns of animal ownership that are thought to characterize different levels of wealth/material style of life?

What patterns of transfer and disposal (including slaughter) of animals are generally seen to accompany different kinds of economic transitions, meeting of short-term crises, etc.?

What has been the history of the community with regard to the maintenance and improvement (or decline) in stock quantities and quality?

In what ways might the death, transfer, sale, or slaughter of animals be seen as fairly strong indicators of "coping with challenge situations?" (See "Coping with Challenge Events" section below)

3. Tools, Equipment, and other Technical Resources.

What are the main tools and equipment that differentiate people in terms of "level of subsistence resources?"

What patterns of maintenance and substitutions of equipment are found in the local area?

What patterns of joint ownership, sharing, non-sharing, hiring, and communal utilization of equipment, tools, etc. are important for subsistence activities in the local area?

What short-term supplies -- e.g. seeds, fertilizers, etc. are significant factors in production?

Is there fishing, hunting, gathering, gleaning, or other additions to primary subsistence pursuits?

4. Other income and subsistence sources?

What other income sources/resources are important as baseline information for examining social performance?

a. wage labor patterns (adult female, adult male, children?)

b. pensions, "gifts" from children and relatives in the city or other places?

c. production and sale of craft items or other products?

d. contributions or exchanges among relatives or other inter-household sharing.

e. production of services.

f. govt. food alotments, other contributions from the outside (including from religious organizations, military, or others.)

g. sale of animals, food products, etc.

Where possible, it would be important to find out the usual patterns and ranges of crop yields and other annual or periodic contributions to the subsistence of families.

5. Decision-making

Which household members organize and control the forces of production?

What conditions lead to renegotiation or reallocation of roles?

6. Re: Children of School Age

a. In School Performance:

What are the local interpretation of official school attendance requirements? of school performance?

What non-health factors affect children's school attendance? (e.g. what work obligations, transportation problems, etc.?

Who makes the decisions about whether a child goes to school, or stays home from school in order to work, etc.?

Who decides when a child is sick and should not go to school?

Are the local rules and expectations for boys different than for girls?

What methods and standards are used to evaluate children's academic performance in the schools?

How are school age boys and girls "motivated" to achieve or excel, academically?

What "extra-curricular" e.g. excursions, phys. training, organized play, etc. occur regularly, and how closely is participation controlled or monitored?

What seasonal factors affect children's school attendance/performance?

b. At Home:

What are the usual activities and expectations of children in food production, animal care, food preparation, crafts, child care, sweeping, cleaning other maintenance, etc.?

How strongly or rigidly are such expectations maintained in different households?

How are sex differences in work expectations expressed?

Who monitors, trains children in home chores, other performances?

Expectations of performance (chores, home care, etc.) for kin and others outside the household e.g. caring for or helping grandparents, or invalids or other kin who have no children at home?

Wage work opportunities and expectations?

Special summer (or other seasonal) chores, tasks, performances?

c. Other Behavioral Areas of Children:

Organized formal activities--

What organized formal activities -- at church, scouts, other organizational contexts are present and regularly include many or most of local children?

Informal activities--

What kinds of regular, patterned activities of play, sports, excursions, etc. take place among children in peer groups or other contexts -- away from home work or school contexts?

GENERAL QUESTION:

When children are not actively involved in one or more of the above, what reasons are given? Voluntary choice? Illness? Laziness? Social status? Special status? Lack of skills/training? Lack of kin support? Specific sex and age roles? Are these children being punished? Socially ostracized?

7. Re: Adult lead female and adult lead male

Ethnographic reconnaissance should provide information on the specific activities of the lead male and female for quantification purposes. (Refer to Appendices 4A, 4B, 5A, and 5B).

8. Observations Related to Challenge Events

In addition to the functions previously mentioned for the ethnography, it should also identify the more frequently encountered challenge events and a profile of a typical challenge response if it exists. Observation should also identify milestones or life events that are culture-specific and of importance in the community. The ethnography should add to or substract from the list of life events presented in Appendix 7 of this report.

53

HOUSEHOLD FOOD SUPPLY/INDIVIDUAL FOOD INTAKE
DATA-GATHERING INSTRUMENT

(For review and comment)

Submitted by:

Norge W. Jerome, Ph.D.
Judith A. Ricci
University of Kansas

7-DAY HOUSEHOLD FOOD INVENTORY & INDIVIDUAL FOOD INTAKE DATA SHEET

Household Code Number: _____

DAY 1[1]

FOOD CATEGORY[2]	HOUSEHOLD INVENTORY DAY (INITIAL) FOOD ITEM	AMT.	STATE	♀ LEAD FEMALE FOOD ITEM	AMT.	STATE	CHILD (PRESCHOOL) FOOD ITEM	AMT.	STATE
BEVERAGES (other than milk)									
EGGS									
FATS & OILS									
FISH/MEAT/POULTRY									
FRUIT									
GRAINS/GRAIN PRODUCTS									
LEGUMES									
MILK & MILK PRODUCTS									
MIXED DISHES (includes combinations of several food categories - components based on recipe)									
NUTS									
SOUPS (includes combinations of several food categories, components based on recipe)									
SUGAR & SWEETS									
VEGETABLES (other than legumes)									
FLAVORINGS SEASONINGS CONDIMENTS									
TOTAL ENERGY - DAY 1									

[1] Inventory day (initial)

[2] provisional (based on U.S. model) - will be reassessed following initial field study

[3] customary mode of preparation - e.g. beer

[4] see [illegible]

CODE - STATE OF FOOD WHEN RECORDED:

Baked -	BK	Dried -	DR	Powdered -	PW	Steamed -	ST
Boiled -	BO	Fried -	FR	Raw -	R	Stewed -	SW
Bottled/Carton -	BC	Frozen -	FZ	Roasted -	RO	Toasted -	TO
Braised -	BS	Grilled -	GR	Salted/Cured -	SC		
Broiled -	BR	Parched -	PA	Smoked -	SM		
Canned -	CN	Pickled -	PI	"Standard" -	STD		

55

7-DAY HOUSEHOLD FOOD INVENTORY & INDIVIDUAL FOOD INTAKE DATA SHEET

Household Code Number _____

DAY 2

FOOD CATEGORY	HOUSEHOLD: FOOD ITEM ADDED (+)	AMT	STATE	HOUSEHOLD: FOOD ITEM SUBT'D (−)	AMT	STATE	♂ LEAD MALE: FOOD ITEM	AMT	STATE	CHILD (SCHOOL-AGE): FOOD ITEM	AMT	STATE
BEVERAGES (other than milk)												
EGGS												
FATS & OILS												
FISH/MEAT/POULTRY												
FRUIT												
GRAINS/GRAIN PRODUCTS												
LEGUMES												
MILK & MILK PRODUCTS												
MIXED DISHES (includes combinations of several food categories - components based on recipe)												
NUTS												
SOUPS (includes combinations of several food categories, components based on recipe)												
SUGAR & SWEETS												
VEGETABLES (other than legumes)												
FLAVORINGS SEASONINGS CONDIMENTS												
TOTAL ENERGY (kcal)												

CODE - STATE OF FOOD WHEN RECORDED

Baked =	BK	Dried =	DR	Powdered =	PW	Steamed =	ST
Boiled =	BO	Fried =	FR	Raw =	R	Stewed =	SW
Butter/fat added =	BF	Frozen =	FZ	Reconst =	RC	Toasted =	TO
Broiled =	BR	Grilled =	GR	Sautéed =	SC		
Canned =	CN	Roasted =	RT	Scrambled =	SM		

56

7-DAY HOUSEHOLD FOOD INVENTORY

Household Code Number _____

DAY 3

HOUSEHOLD

FOOD CATEGORY	FOOD ITEM ADDED ⊕	AMOUNT	STATE	FOOD ITEM SUBTRACTED ⊖	AMOUNT	STATE
BEVERAGES (other than milk)						
EGGS						
FATS & OILS						
FISH/MEAT/POULTRY						
FRUIT						
GRAINS/GRAIN PRODUCTS						
LEGUMES						
MILK & MILK PRODUCTS						
MIXED DISHES (includes combinations of several food categories, components being unmixed)						
NUTS						
SOUPS (includes combinations of several food categories, components being unmixed)						
SUGAR & SWEETS						
VEGETABLES (other than legumes)						
FLAVORINGS SEASONINGS CONDIMENTS						
TOTAL ENERGY						

KEY: STATE OF FOOD WHEN REFRIGERATED

Baked =	BK	Dried =	DR	Powdered =	PW	Steamed =	ST
Boiled =	BO	Fried =	FR	Raw =	R	Stewed =	SW
Butter fried =	BF	Frozen =	FZ	Roasted =	RO	Toasted =	TO
Deep fried =	DF	Grilled =	GR	Salted/cured =	SC		
Poached =	PO	Pureed =	PA	Smoked =	SM		

7-DAY HOUSEHOLD FOOD INVENTORY & INDIVIDUAL FOOD INTAKE DATA SHEET

Household Code Number _____

DAY 4

FOOD CATEGORY	HOUSEHOLD: FOOD ITEM ADDED (+)	AMT	STATE	HOUSEHOLD: FOOD ITEM USED (−)	AMT	STATE	♀ LEAD FEMALE: FOOD ITEM	AMT	STATE	CHILD (PRESCHOOL): FOOD ITEM	AMT	STATE
BEVERAGES (other than milk)												
EGGS												
FATS & OILS												
FISH/MEAT/POULTRY												
FRUIT												
GRAINS/GRAIN PRODUCTS												
LEGUMES												
MILK & MILK PRODUCTS												
MIXED DISHES (include combinations of food items/components below in recipe)												
NUTS												
SOUPS (include combinations of grains/ food items/components below in recipe)												
SUGAR & SWEETS												
VEGETABLES (other than legumes)												
FLAVORINGS SEASONINGS CONDIMENTS												
TOTAL ENERGY (cal)												
TOTAL ENERGY FOR LEAD ♀ & PRESCHOOL CHILD FOR 2 DAYS												

KEY - STATE OF FOOD WHEN PREPARED

Baked =	BA	Dried =	DR	Powdered =	PW	Shelled =	SH
Boiled =	BO	Fried =	FR	Raw =	R	Stewed =	SW
Butter/fat =	BF	Frozen =	FZ	Roasted =	RO	Toasted =	TO
Broiled =	BR	Grilled =	GR	Sautéed/fried =	SF		
Brined =	BN	Pureed =	PR	Smoked =	SM		

7-DAY HOUSEHOLD FOOD INVENTORY & INDIVIDUAL FOOD INTAKE DATA SHEET

Household Code Number _____

DAY 5

FOOD CATEGORY	HOUSEHOLD: FOOD ITEM ADDED (+)	AMT	STATE	HOUSEHOLD: FOOD ITEM SHARED (−)	AMT	STATE	♂ LEAD MALE: FOOD ITEM	AMT	STATE	CHILD (SCHOOL-AGE): FOOD ITEM	AMT	STATE
BEVERAGES (other than milk)												
EGGS												
FATS & OILS												
FISH/MEAT/POULTRY												
FRUIT												
GRAINS/GRAIN PRODUCTS												
LEGUMES												
MILK & MILK PRODUCTS												
MIXED DISHES (includes combinations of several food categories/components below or recipes)												
NUTS												
SOUPS (includes combinations of several food categories, component below or recipes)												
SUGAR & SWEETS												
VEGETABLES (other than legumes)												
FLAVORINGS SEASONINGS CONDIMENTS												
TOTAL ENERGY = TDF												
Total energy intake of household (sum of individual totals for 7 days)												

KEY: STATE OF FOOD WHEN PREPARED

Baked =	BK	Dried =	DR	Powdered =	PW	Steamed =	ST
Boiled =	BO	Fried =	FR	Raw =	R	Stewed =	SW
Bottled/Canned =	BC	Frozen =	FZ	Roasted =	RO	Toasted =	TO
Broiled =	BR	Grilled =	GR	Salted/Cured =	SC		
Steamed =	SM	Smoked =	SK	Sautéed =	SM		

59

FOUR HOUSEHOLD FOOD INVENTORY

Household Code Number _____

DAY 6

HOUSEHOLD

FOOD CATEGORY	FOOD ITEM ADDED ⊕	AMOUNT	STATE	FOOD ITEM SUBTRACTED ⊖	AMOUNT	STATE
BEVERAGES (other than milk)						
EGGS						
FATS & OILS						
FISH/MEAT/POULTRY						
FRUIT						
GRAINS/GRAIN PRODUCTS						
LEGUMES						
MILK & MILK PRODUCTS						
MIXED DISHES (includes combinations of several food categories - components based on recipes)						
NUTS						
SOUPS (includes combinations of several food categories, components based on recipes)						
SUGAR & SWEETS						
VEGETABLES (other than legumes)						
FLAVORINGS SEASONINGS CONDIMENTS						
TOTAL ENERGY (kcal)						

KEY - STATE OF FOOD WHEN RECORDED

Baked -	BK	Dried -	DR	Powdered -	PW	Steamed -	ST
Boiled -	BO	Fried -	FR	Raw -	R	Stewed -	SW
Butter/Fat in -	BF	Frozen -	FZ	Roasted -	RO	Toasted -	TO
Braised -	BS	Grilled -	GR	Salted/Cured -	SC		
Broiled -	BR	Pickled -	PK	Smoked -	SM		

60

7-DAY HOUSEHOLD FOOD INVENTORY & INDIVIDUAL FOOD INTAKE DATA SHEET

Household Code Number _____

DAY 7

FOOD CATEGORY	HOUSEHOLD: FOOD ITEM ADDED (+)	AMT	STATE	HOUSEHOLD: FOOD ITEM USED (−)	AMT	STATE	♀ LEAD FEMALE (if pregnant): FOOD ITEM	AMT	STATE	CHILD (PRE-SCHOOL if breast-feeding): FOOD ITEM	AMT	STATE
BEVERAGES (other than milk)												
EGGS												
FATS & OILS												
FISH/MEAT/POULTRY												
FRUIT												
GRAINS/GRAIN PRODUCTS												
LEGUMES												
MILK & MILK PRODUCTS												
MIXED DISHES (includes combinations of several food categories - components based on recipe)												
NUTS												
SOUPS (includes combinations of several food categories, component based on recipe)												
SUGAR & SWEETS												
VEGETABLES (other than legumes)												
FLAVORINGS SEASONINGS CONDIMENTS												
TOTAL ENERGY - DAY 7												
TOTAL ENERGY FOR LEAD & PRESCHOOL CHILD FOR 3 DAYS												

$ Concordant food intake data should be collected only if the lead female is pregnant or the preschool child is breast-feeding.

CODE - STATE OF FOOD WHEN RECORDED

Baked -	BK	Dried -	DR	Powdered -	PW	Steamed -	ST
Boiled -	BO	Fried -	FR	Raw -	R	Stewed -	SW
Butter/Margarine -	BC	Frozen -	FZ	Roasted -	RO	Toasted -	TO
Broiled -	BR	Grilled -	GR	Salt/Spiced -	SC		
Canned -	CN	Pickled -	PK	Smoked -	SM		

7-DAY HOUSEHOLD FOOD INVENTORY

Household Code Number _____

DAY 8*

HOUSEHOLD INVENTORY DAY
(FINAL)

FOOD CATEGORY	FOOD ITEM	AMOUNT	STATE
BEVERAGES (other than milk)			
EGGS			
FATS & OILS			
FISH/MEAT/POULTRY			
FRUIT			
GRAINS/GRAIN PRODUCTS			
LEGUMES			
MILK & MILK PRODUCTS			
MIXED DISHES (includes combinations of several food categories - components listed on recipe)			
NUTS			
SOUPS (includes combinations of several food categories, components listed on recipe)			
SUGAR & SWEETS			
VEGETABLES (other than legumes)			
FLAVORINGS SEASONINGS CONDIMENTS			
[illegible]			
[illegible]			

* inventory day (final)

KEY - STATE OF FOOD WHEN PREPARED

Baked -	BA	Dried -	DR	Fried -	FR	Steamed -	ST
Boiled -	BO	Fried -	FR	Raw -	R	Stewed -	SW
Butter/Oil -	BO	Frozen -	FZ	Roasted -	RO	Toasted -	TO
Broiled -	BR	Grilled -	GR	Sautéed -	SS		
Canned -	CA	Pickled -	PK	Smoked -	SM		

62

DRAFT

FIELD MANUAL FOR ANTHROPOMETRY

NUTRITION CRSP

PREPARED BY UNIVERSITY OF ARIZONA

C. Ritenbaugh
M. Mohs
G. Harrison

with liberal use of materials developed by A. Zerfas (UCLA)

4/82

Anthropometric Manual - Title XII

Table of Contents

I. Introduction
- A. Purpose 1
- B. Types of Errors 1
- C. Responsibilities of measurer and partner 1
- D. Clothing 2

II. Height
- A. Equipment
  - Design 3
  - Care and Maintenance 4
  - Reading Areas 4
- B. Step-Wise Procedures
  - Preparation 10
  - Instructions and Positions 10
  - Measurement 11
- C. Critical Performance Test 11
- D. Special Problems and Error Checklist 12
  - Measuring Supine Length in Infants 14

III. Weight
- A. Equipment
  - Design 15
  - Care and Maintenance 15
  - Reading Areas 18
- B. Step-Wise Procedures
  - Preparation 24
  - Instructions and Positions 24
  - Measurement 24
- C. Critical Performance Test 25
- D. Special Problems and Error Checklist 25

IV. Mid-Upper Arm Circumference
- A. Equipment
  - Design 27
  - Care and Maintenance 27
  - Reading Areas 29
- B. Step-Wise Procedures
  - Preparation 29
  - Instructions and positions 29
  - Measurement 33
- C. Critical Performance Test 34
- E. Special Problems and Error Checklist 34

V. Quality Control
- A. Introduction 39
- B. Zerfas' Standardization Exercise 39
- C. Recording and reporting of measurement error 44

I INTRODUCTION

A. PURPOSE

The purpose of this manual is to provide sufficient detail regarding anthropometric methods for core measurements to standardize procedures across all projects.

This manual is directed toward techniques for accuracy and precision of measurements, successful production of subject cooperation, and systematic quality control. It is written for field personnel and it is assumed that demonstration, practice, and review sessions will be used for training field personnel. Of course, each project will have to adapt the manual for its particular local conditions and language.

Chapters II - IV consist of detailed descriptions of procedure for the three Phase I core measurements - height (length), weight, and mid-upper arm circumference. The section for each measure covers equipment, step-wise procedures, special problems, reading areas on the relevant instrument, exercises for training, equipment care and maintenance, and a critical performance test to evaluate techniques. Chapter V includes information on a formal standardization exercise and on the treatment of data on measurement reliability.

This manual assumes that a pair of fieldworkers (a "measurer" and a "partner") will be working together.

B. TYPES OF ERROR

Reading and Recording Errors

Two types of error may occur in taking anthropometric measurements. Large errors may result from misreading the instrument, and calling out the wrong values. Recording errors are often due to poor writing (e.g., 6 or 9 looks like 0, 1 like 7), inversion (45 written as 54), or writing the result in the wrong part of the form.

Measurement Technique Errors

These are specific for each measure and it is important to keep them to a minimum. For practical reasons, no measure is perfect; however, we expect the measurer's technique to be consistently excellent. In this way, results will be very close to the true value. Errors in measuring technique may arise from the equipment, the subject or the measurer. The field team (measurer and partner) are responsible for using the proper techniques to avoid all three types of error.

C. RESPONSIBILITIES OF MEASURER AND PARTNER -- WHO DOES WHAT?

Both the measurer and the partner are responsible for:

..equipment placement, maintenance and safety;
..correct measurement result and cross check;
..decision on clothing, special problems (such as uncooperative child);
..comfort (physical and mental) of child;
..scheduling;
..questionnaire form filled out correctly and checked;
..decision to repeat measurement, if required.

The measurer will:

..control all steps of the measurement;
..read and call out result;
..cross check written result with that measured;
..insure own ID is written

The partner will:

..assist measurer (e.g. in correct positioning of child, assuring that individual is standing still on scale;
..check measurer's technique;
..record result;
..call out result and cross-check with that measured;
..assist child, when necessary, to disrobe.

It is possible that in the actual survey one team member could be the measurer for weight and height, and the other for arm circumference. This will depend on training performance evaluation. IT IS IMPORTANT THAT THE SAME MEASURER DOES THE SAME MEASURE THROUGHOUT ALL THE SURVEY. On each form the measurer ID must be written for that measure. This will enable proper supervision and interpretation of the results. If, for any reason, the measurer is not available to do body measures; the partner will do them (noting his/her ID).

At all times two people are necessary for the height measurement. At times only one person may be available for the other measures. In that case, the measurer alone must take over both functions (measurer and partner) for the procedure. This will include recording and cross-checking the result. It is important the measurer be especially careful at such times. If problems arise, (e.g. difficult child) someone else should be called for assistance.

D. CLOTHING

The type and weight of clothing will vary from subject to subject, and will pend on many factors including climate, sex, and age. During the survey it will not be possible to fully standardize clothing worn at the time of measurement. The step-wise procedure for each measure indicates the clothing to be removed. For weight, a general rule is for clothing to be removed to the last layer next to the underwear (within privacy constraints). Thus it is important that the measurements be done in a place ensuring privacy and relative warmth.

It is extremely important that the subject be approached in a discrete and tactful manner so as to minimize the subject's discomfort or embarrassment.

Prior to the first measure (weight) you should say to the subject:

"We will now measure your weight, height, and left arm. This will take about 5 minutes. For these measures to be correct, it is necessary for you to remove some of your clothes.

"Please take off all footwear including socks (except for thin stockings), any coat, sweater, and outer clothing, and belt, glasses, accessories, jewelry, and watch. Be sure all your pockets are empty. Put your valuables in this container, which will be kept in a safe place until all the measures are completed. Make sure your left shoulder and arm are exposed."

If the subject refuses to take off the required clothes, say, "it is really important for you to do this; otherwise the measures will be invalid." If the subject is still uncooperative, start the measures, and record the conditions which interfered with the measurement in the section marked "conditions" on the measurement form.

For left upper arm measures it is only necessary for the left shoulder and arm to be bared. However, for convenience, it is best that the subject not reclothe until all measures are completed since it is occasionally necessary to repeat weight and/or height measures. For accurate arm measures, tight long sleeves must be fully detached. It is unsatisfactory to roll these up the arm. Loose-fitting short-sleeved garments can remain, provided they can be rolled up above the shoulder tip.

If the left shoulder tip and/or upper arm cannot be exposed properly, arrange for these measures to be performed later when arm exposure is possible. If such arrangements are not feasible, proceed with the measures to the degree possible, and note the circumstances in the "condition" section on the measurement form.

II HEIGHT

A. EQUIPMENT

Design

The height board will be used to measure height in cm for this project. English/metric tapes are installed by the manufacturer on the CDC portable length/stature measuring board which has been chosen for use. The board can be purchased from Perspective Enterprises, and the price in the past has been $134.50. A 60 to 90-day lead time is suggested for delivery. If you choose to construct the board yourself, plans are available from the Nutrition Division, CDC. The cost of construction has been approximately $90.00 in the past. The measuring tapes are manufactured by Roe International, Inc., 219 River Avenue, Patchogue, N.Y. 11772, but the manufacturer deals with the public only through distributors. A distributor which has

dealt in the past in small orders is: Perspective Enterprises, 7466 Thrasher Lane, Kalamazoo, Michigan 49009. Tel: (616)375-8081. The price has been $2.35 plus shipping. The height board has several components, which are labeled in Figure 1. There are several movable parts to this piece of equipment. The extension pole and the headpiece are easily removable, and the platform folds up on its hinge. Special care is required during carrying, packing, and unpacking in order to prevent damage.

CARE AND MAINTENANCE

Packing — Always pack in cardboard box when not in use. Strap the extension pole and platform to the upright board. Pack the headpiece separately in its bag. When unpacking carefully remove from the box. Don't allow any of the components to drop on the floor or ground.

Vehicle Transport — Lay box flat.

Carrying — Carry the headpiece separately from the upright board. Release the platform clip; this will allow the platform to rotate towards the board. For long distances, strap the extension pole and platform to the upright board, as for packing. Carry the headpiece in its bag. Grip the carrying hole, so that the platform is in front and tilting down slightly.

Setting up for the measure — Place board upright; lock platform clip; insert headpiece; insert extension pole; tighten measuring bar (if loose).

Problems of Wear, Breakdown

Repair Kit & Spare Parts — Hammer/screwdriver/glue/nails/screws; extra headpiece; pieces of metal tape, and strapping.

Problem Areas — The topmost part of the central pole is a thin, exposed area and if damaged, wood may fray or split. Repair immediately with glue; otherwise the sliding piece cannot fit over the pole. A similar, less common problem may occur with the lower end of the extension pole. The headboard may separate from the handle; this requires gluing and/or screwing. The metal tape at the upper end of the central pole or lower end of extension pole may separate. If this occurs, reglue immediately and clamp. If the metal splits and the tape numerals are ill-defined, overlay and glue the corresponding metal tape spare part.

READING AREAS

Graduations — There are two sets of graduations on the 3/4 inch-wide tape. Looking at the tape vertically, one sees that the left side contains inch graduations in 16ths of inches. The right side contains metric graduations in

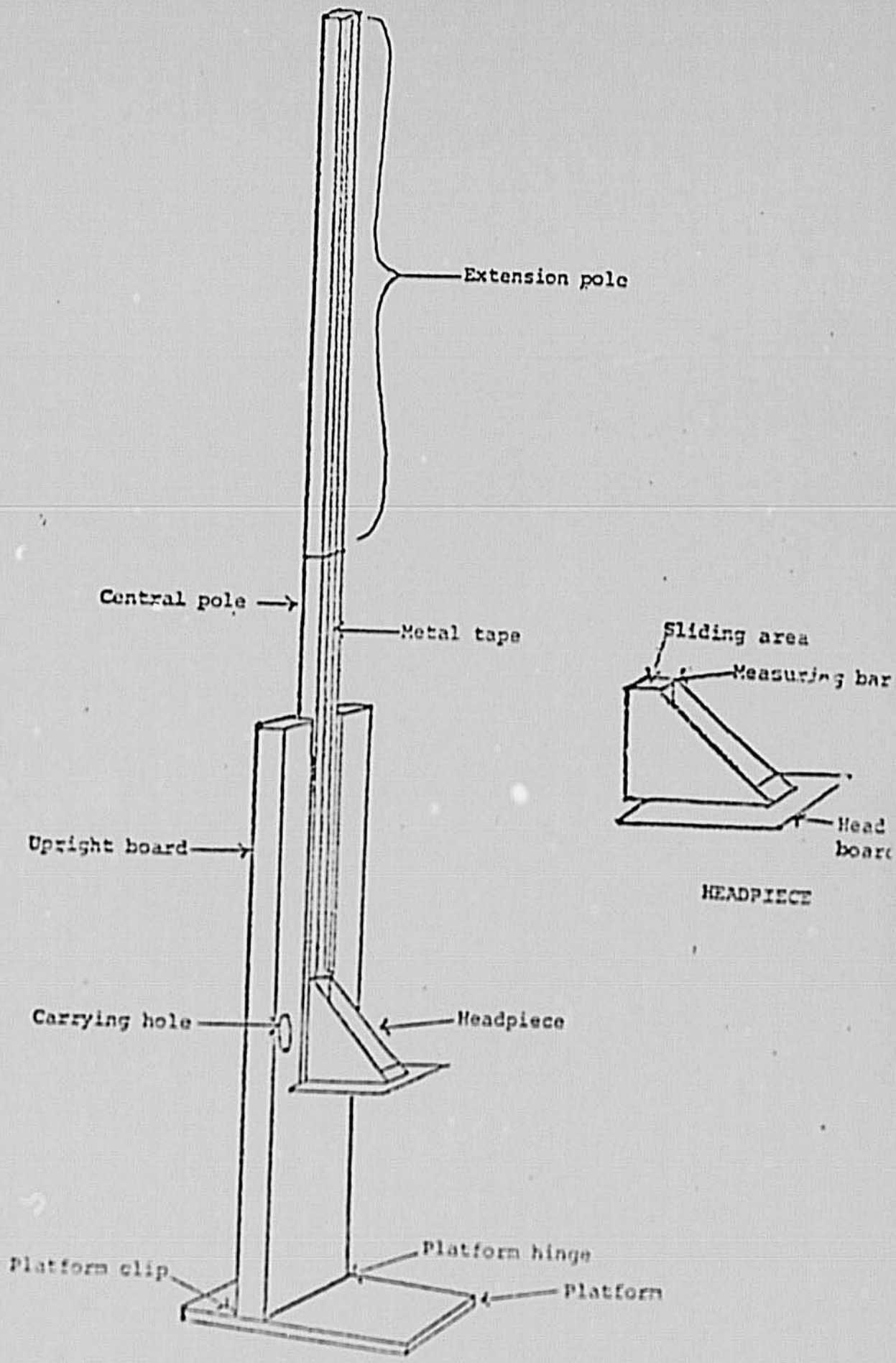


Figure 1. Portable Length/Stature Measuring Board

centimeters (cm) and in millimeters (mm). A red central line extends along the entire length of the tape. The longest metric graduation lines which are 5/16" long and extend from the outer right edge almost to the red central line, are for cm. The next longest graduations are for the ½ cm. The shortest graduations are the mm ones.

Numerals

Each 10 cm is denoted by red numerals. All other cm are denoted by black numerals. The metric numerals are located to the right of the red central line at the center of the tape. Individual mm lines are at the outer right edge of the tape and are not numbered.

Reading Procedure

Note that graduations and numerals are aligned with the tape length. Hence, you must tilt your head sideways for reading. Also, because the sliding piece covers all graduations and numerals below the reading area, a subtraction procedure is required for reading. Procedure:
..identify the first centimeter graduation to the right of (or above - when pole is vertical) the reading bar,
..note the corresponding complete numéral (e.g., 250),
..subtract 1 from the result (e.g. 250-1=249),
..to derive millimeters, count the number of graduations below the centimeter graduation noted up to the last one, next to and above the reading bar. Subtract result from 10. (With practice you will develop short cuts to this step, i.e., use the 5 mm graduations as markers).
Examples are shown on the next page, followed by two pages of practice sets.

One page of the practice sets can be used for initial reading practice, and the second for a test to be checked by a supervisor for correct reading. The correct answers are:

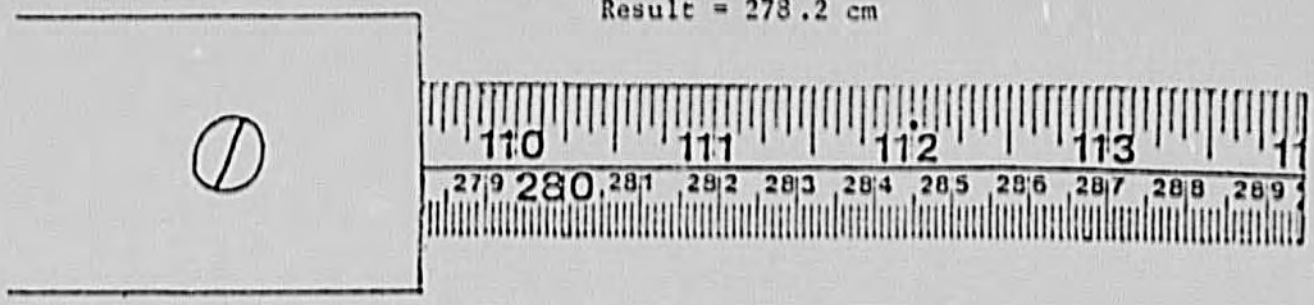
1:	296.7 cm	11.	296.2 cm
2:	287.1 cm	12.	286.5 cm
3:	280.0 cm	13.	280.0 cm
4:	292.6 cm	14.	292.1 cm
5:	302.1 cm	15.	301.4 cm
6:	302.0 cm	16.	301.3 cm
7:	284.8 cm	17.	284.7 cm
8:	281.7 cm	18.	281.4 cm
9:	276.3 cm	19.	275.8 cm
10:	298.5 cm	20.	297.2 cm

Height Reading Area Examples

a. 1) Centimeter graduation at 279 (279-1=278)

2) 8 graduations below this, 10-8=2

Result = 278.2 cm



b. 1) Centimeter graduation at 293 (293-1=292)

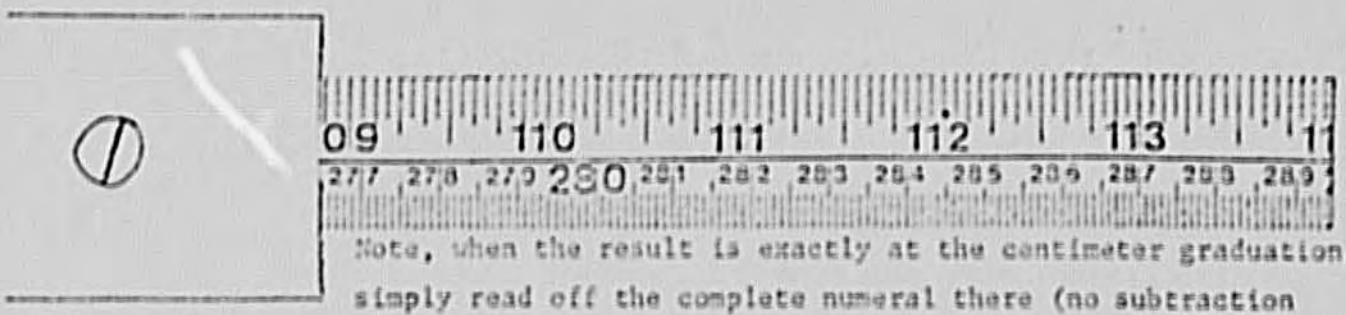
2) 2 graduations below this, 10-2=8

Result = 292.8 cm

c. 1) Centimeter graduation at 277 (277-1=276)

2) 5 graduations below, 10-5=5

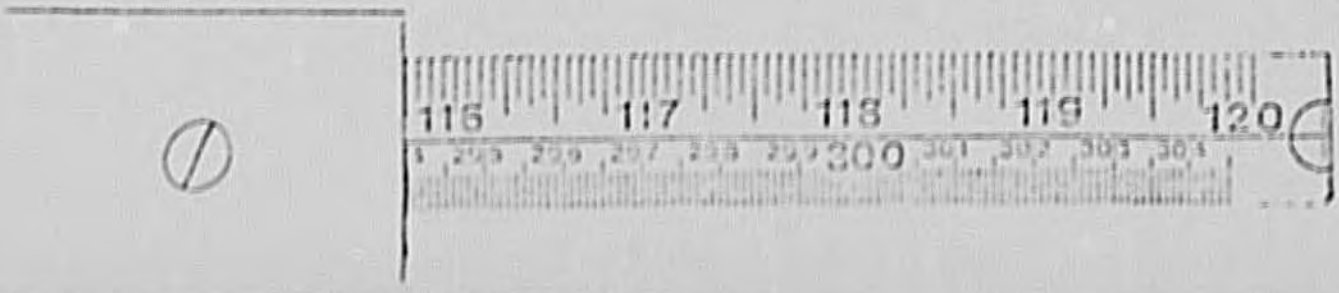
Result = 276.5 cm

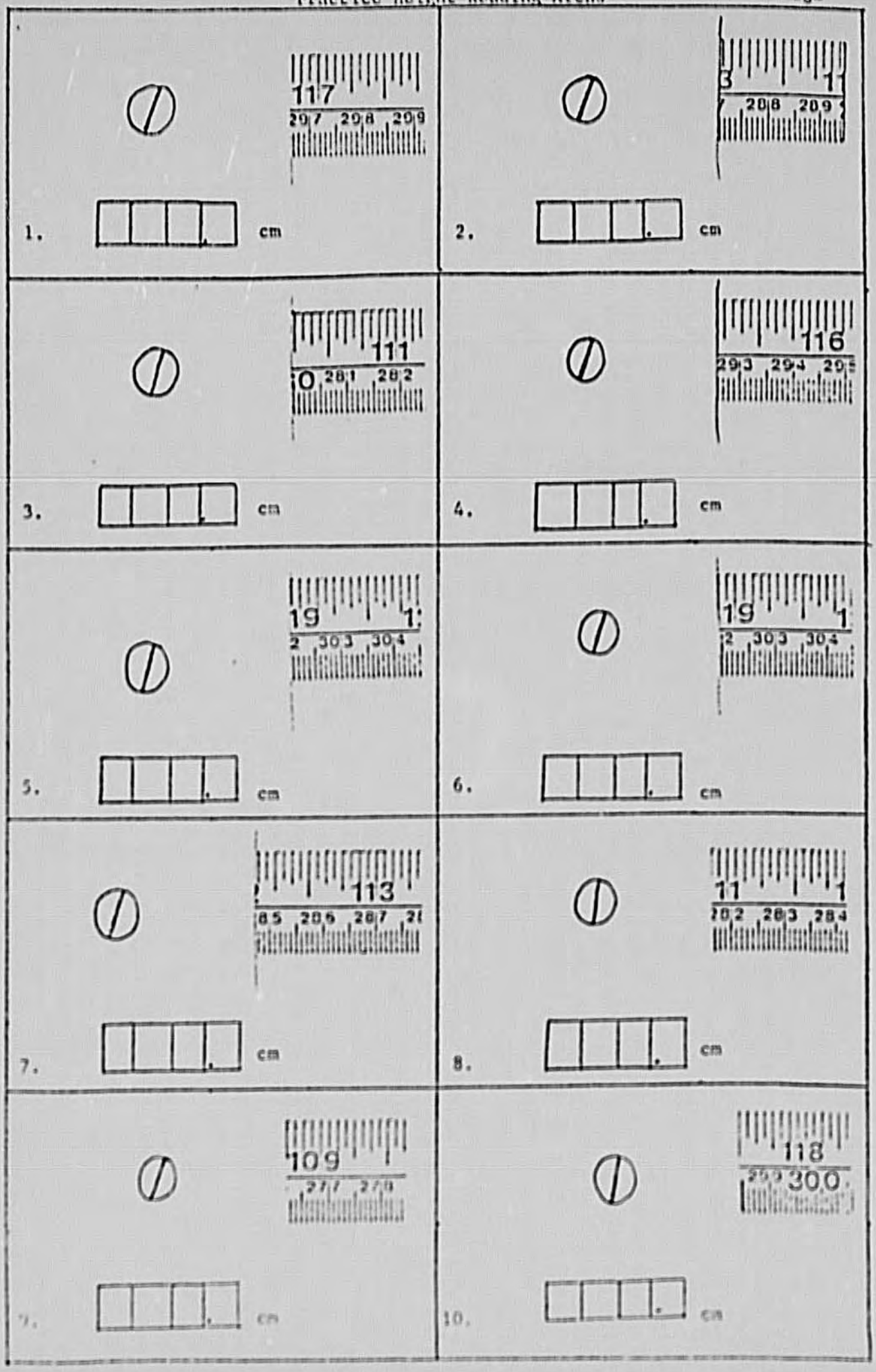


Note, when the result is exactly at the centimeter graduation, simply read off the complete numeral there (no subtraction required)

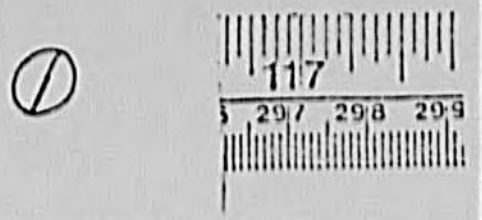
d. 1) Centimeter graduation exactly at 294 cm

Result = 294 cm (This is the same as subtracting 294-1=293, + 10-0=10/10cm = 294 cm)

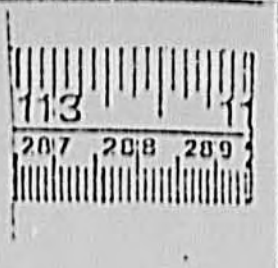



1.
cm
2.
cm
3.
cm
4.
cm
5.
cm
6.
cm
7.
cm
8.
cm
9.
cm
10.
cm

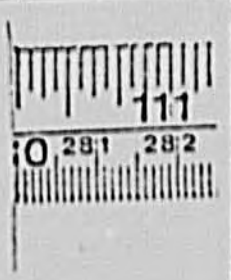
Practice Metric Reading Areas



11. ☐☐☐.☐ cm

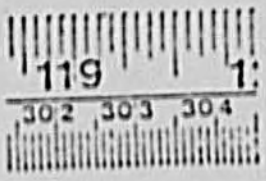


12. ☐☐☐.☐ cm

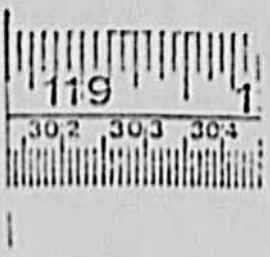


13. ☐☐☐.☐ cm

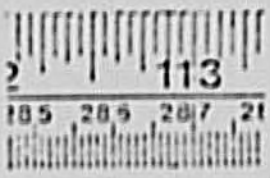
14. ☐☐☐.☐ cm



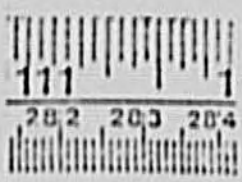
15. ☐☐☐.☐ cm



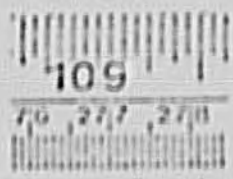
16. ☐☐☐.☐ cm



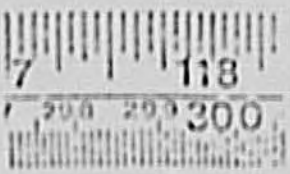
17. ☐☐☐.☐ cm



18. ☐☐☐.☐ cm



19. ☐☐☐.☐ cm



20. ☐☐☐.☐ cm

B. STEP-WISE PROCEDURES

Preparation

Have equipment ready: height board, data form, clipboard, and pencil.

Prepare subject: ensure all footwear is removed (except for thin stockings). Ensure all possible headgear is removed (this must be adjusted for different populations within reason)
Ensure hair and veil arrangement likely to interfere with measurement are loosened.

Adjust height board: slide headpiece up the central pole to about a foot above the expected height of the subject. Hold headpiece in this position with your left hand.

Position the measuring team: the measurer stands at subject's left side. The partner stands at subject's right side.

Instructions & Positions

Give instructions to subject: "We are going to measure your height very carefully and accurately. First, stand on the platform with your back against the board. Stand flatfooted, feet together, and as straight as you can. Make sure your knees are straight. The back of your heels, legs, body, and head should all press against the upright board. Look straight ahead. Try to make yourself as tall as possible without lifting your heels off the ground."

Position the subject: Assist subject to stand on board correctly. Show a picture of the ideal position and demonstrate if necessary. Repeat above instructions as required. Gently lower the headpiece until it rests lightly on crown of subject's head.

Check the subject's position: ensure subject looks straight ahead. (A line drawn from the external ear opening to the lower bony part of the eye socket should be horizontal.) Ensure back of subject's head touches the upright board.

Have partner check the subject's position: partner to ensure subject stands flatfooted with knees straight, and that back of heels, calves, buttocks, trunk and shoulders all touch the surface of the upright board. When position is correct, partner should call out "position o.k.."

Measurement	Measure subject: check head placement. Hold headboard firmly against crown of head, crushing thick hair, if necessary. Read value to the nearest millimeter. Continue to hold headpiece steady. Record and check measurement: first, read the whole number of centimeters, then milimeters. Call out result to partner. EXAMPLE: Centimeters: measurer calls out "48 centimeters." Millimeters: measurer calls out "plus two millimeters." Continue to hold headpiece steady. Partner to record the result on measurement form, look at reading area, and call it back to you. Look at written result and cross-check it with that in the reading area. (If reading is not the same, repeat this step.) To ensure measurer can read the height board, arrange for taller partner to do height measurement, and/or bring along a step stool. Determine if subject appears either very tall or very short for his or her age and mark accordingly on measurement form. When measurement is completed, allow subject to step off the height board and lower the headpiece to its resting position.
C. Critical Performance Test (CPT)	This test checks measuring technique. The essential steps in the step-wise procedures are listed for each measurement. While the measurement is being done your partner (or supervisor) will cross-check each step in turn (using the step-wise procedure list from your manual). An "X" should be marked in the specific box for any incorrect step and a brief comment made below. The measure result will be recorded. The person checking will repeat the measure, writing his/her result below the first measure result. The difference between the two results will be entered. If the difference is equal to or greater than the following values, the reasons for this should be discussed. Weight - 1/10 kg Height - 1/2 cm Arm Circumference - 1 mm.

Each test is listed 1, 2, ...10 at the top. Each measurer keeps a sheet, so that further tests and dates for that measurer will be done on the same sheet.

The critical performance test for height is given on the following page, with sample values to indicate its use.

D. SPECIAL PROBLEMS AND ERROR CHECKLIST

Generally, there are three sources of errors in any type of anthropometric measurement: equipment, subject, and measurer.

Equipment

If the equipment is malfunctioning, no matter how well you can measure, persistent errorsare likely to occur. Examples include non-calibration to zero and equipment damage.

Subject: Errors will occur if the subject does not understand or follow the instructions (e.g. to remove footwear, outer clothing, and pocket contents; to hold still). This is more likely to occur if the subject is cold, uncomfortable or embarrassed by the procedure.

Common types of errors for all measurements: inadequate instrument; restless child (procedure should be postponed if possible; reading part of instrument not fixed when value taken; reading errors; and recording errors.

Common type of errors in measuring height: incorrect instrument for subject's age; footwear or headwear not removed; heels not against vertical platform or wall; feet not flat on horizontal surface; knees bent; body arched or buttocks forward (body not straight) shoulders not straight on board; head not in correct plane; headboard not firmly on crown of child's head.

CRITICAL PERFORMANCE TEST

HEIGHT (example)

Date 5/2

	Measurer: John	Doe								
	1	2	3	4	5	6	7	8	9	10
1. EQUIPMENT READY	X									
2. CLOTHING	X									
3. POSITIONING										
4. HEADPIECE ADJUSTED										
5. INSTRUCTIONS TO CHILD	X									
6. CHILD ON BOARD										
7. TOTAL BODY POSITION	X	X	X							
8. POSITION CHECK										
9. READING										
0 RECORDING										
1. MEASURE CHECK										
MEASUREMENT RESULT	5'10 5/16	5'8 1/16	5'8 3/16	5'6 1/16						
SUPERVISOR'S RESULT	5'10 1/16	5'8 3/16	5'8 6/16	5'6 3/16						
DIFFERENCE	+4/16"	-2/16	-3/16	+2/16						
				✓						

COMMENTS (1.) Form not handy. 2. Thick socks worn. 3. Instructions unclear. 7. Not looking straight ahead.

(2.) Child not straight against board

Mark X in box when step unsatisfactory.

E. MEASURING SUPINE LENGTH IN INFANTS

Infants up to 24 months of age will be measured for supine length instead of for standing height. A measuring team of two people will be necessary to take supine measurements of infant length, because it is essential to position the infant and keep him/her in the correct position until measurement has been completed and verified. The procedure is as follows:

Procedure

Mark the Frankfort plane on the infant by marking a line from the lower border of the left orbit to the upper margin of the external auditory meatus.

Place the infant face up on the horizontal measuring board, with the feet flat against the bottom of the measuring board. It is important to keep the infant's legs straight and to make sure his backbone is not arched by keeping contact between the board and his/her buttocks and shoulders.

One measurer will hold the infant's feet, toes pointing directly upward, and apply gentle traction to bring the bottom of the feet into contact with the fixed footboard.

The second measurer will hold the infant's head with the Frankfort plane perpendicular to the measuring board and also apply gentle traction, bringing the movable headboard to rest firmly against the infant's head.

The measurement will be noted verbally by the first measurer, and confirmed by the second measurer, and recorded in the same manner as that established for height.

Suggestion: The presence of the mother of the infant, or other caretaker, will be helpful in keeping the infant calm. She should be encouraged to speak soothingly to reassure the child.

III WEIGHT

A. EQUIPMENT

Design

The scale used is an Accu-Weigh Bench Beam scale, model 150 TK, which is calibrated in kilograms and has a capacity of up to 150 kg (Figure 4a). It has two sliding weights which can be set in 10 kg and 0.1 kg increments. The weight measure is derived from the combined results of these two weight indicators. Another sliding weight is provided for a "blank" tare, which should be used to bring the scale to zero before each weighing and which will adjust the zero point when placing a basket to hold babies on the scale platform. Figure 4b shows one type of baby basket on the scale. The scale is manufactured by the Metro Equipment Corporation, Box 60037, Sunnyvale, CA, 94088, USA. Phone: (408) 734-5400, telex 352026. The manufacturer states that this scale is available with an optical locking device and carrying handle. As of January, 1982, the quoted price in Tucson was $440, including the platform lock. (See pictures 1 and 2 for main and 0.1 kg indicators).

Care and Maintenance

Transport: a cardboard box is used for packing. When transporting the scale, the box should rest flat on the floor of the vehicle. Take care not to leave the box in an unstable position. When carrying the scale in different locales, or to and from a vehicle, lock the platform lock and carry it carefully by the handle.

Wear and Breakdown

If the scale is dropped or jolted excessively, the fulcrum may become displaced. It is necessary, prior to each day's weighing, to calibrate the scale. A known standard weight will be available in the vehicle. Set the scale and adjust the tare so that the balance is horizontal at zero. Then check the scale to the known weight, that is, use the scale to weigh the standard weight. Record the result and time of the measurement. If the difference is greater than 1/10 kilogram, notify the supervisor.

If a replacement is not possible, the following procedure should replace the zero check in the weight step-wise procedures.

Prior to every weighing session or whenever the scale is moved; 1) unlock scale, 2) zero check (adjust tare), 3) record scale reading with standard weight, 4) set scale indicators according to standard weight and readjust tare weight to make the balance align at those values.

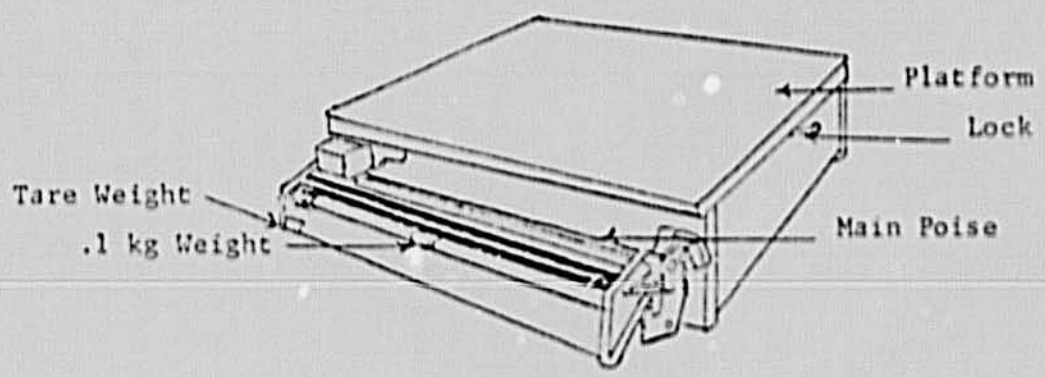
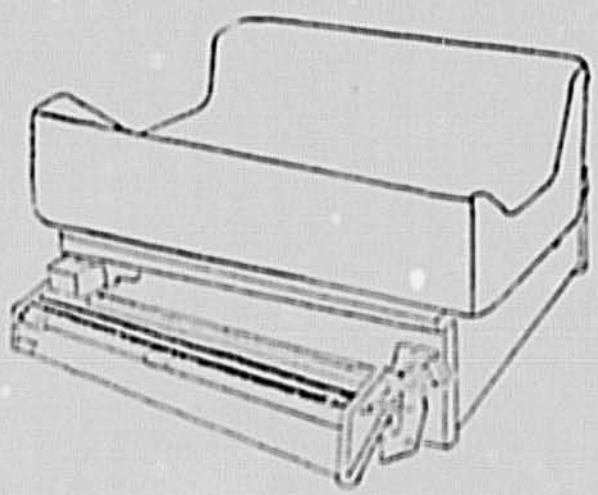


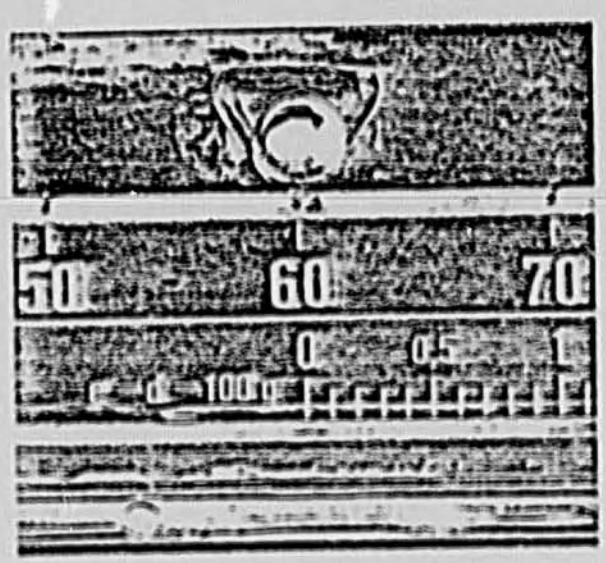
Figure 4a. Accu-Weigh Beam Balance Scale, Model 150 TK

Figure 4b. Accu-Weigh Beam Balance Scale, Model 150 TK,

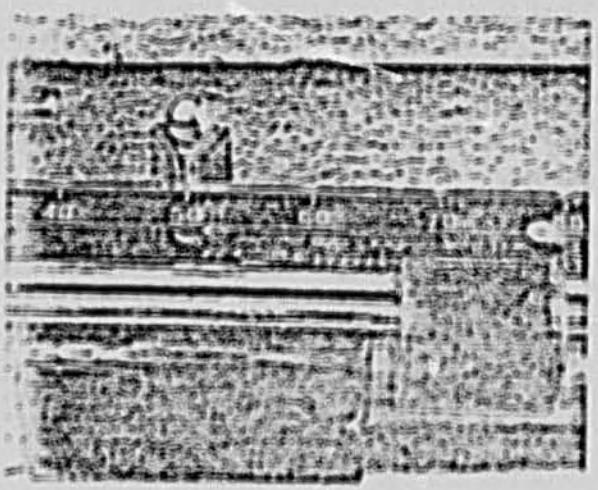


shown with one possible type of baby basket on the platform

1 Main poise indicator (in 10 Kg increments)



2 Secondary, or .1 Kg indicator, on bottom right

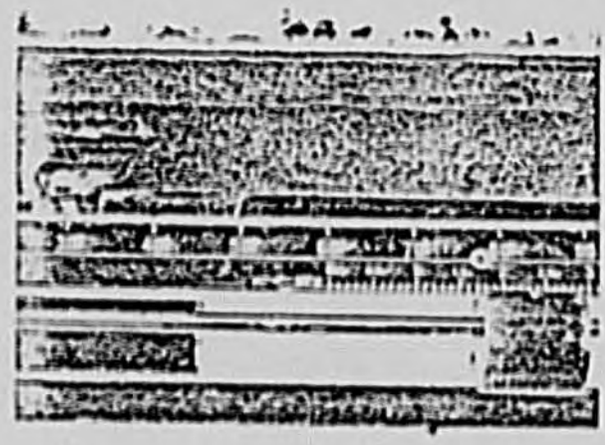


Reading Areas

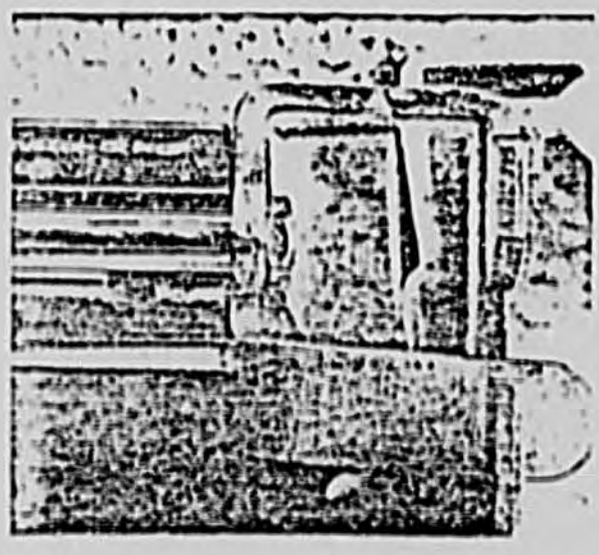
Balance Alignment

The scale principle is that of a beam balance. The platform is connected to the extreme left end of the balance. The fulcrum is set very close to this point. (See picture A). In picture B, the weight indicators are calibrated at zero, so that their leverage effect around the fulcrum equals that of the bar. The balance is horizontal when the tare weight is suitably adjusted. In C. the added weight of the child causes the balance to tilt up at its right end. In D, the weight indicators need to slide to the left to restore the balance to the horizontal position, for they have overcompensated for the weight of the child. It should be clear that even a slight movement of the subject during the weighing will magnify balance movement. This will make measuring much more difficult.

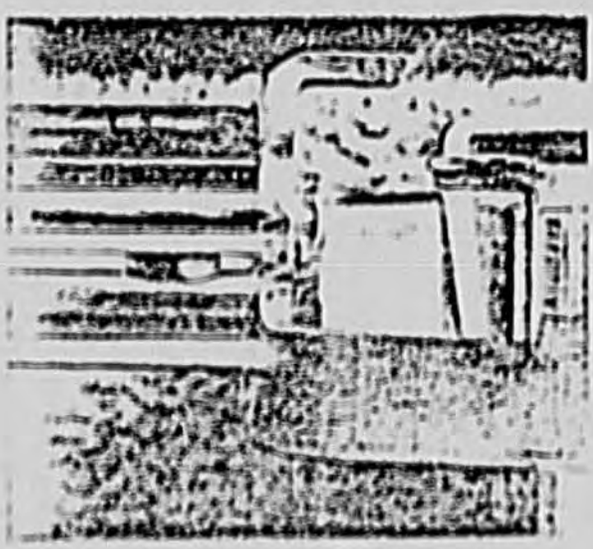
A



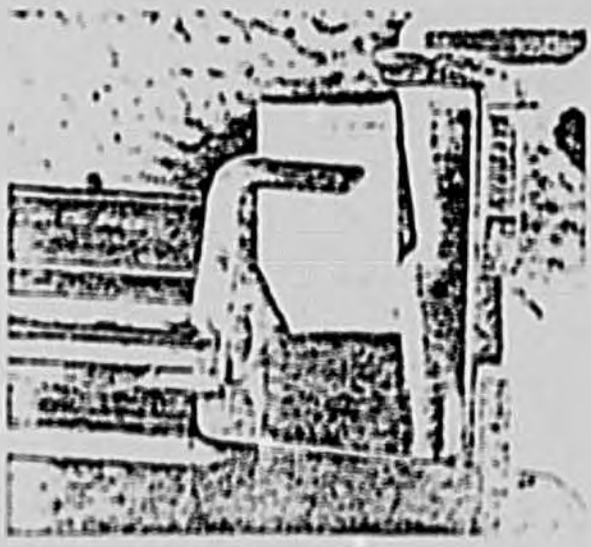
B



C



D

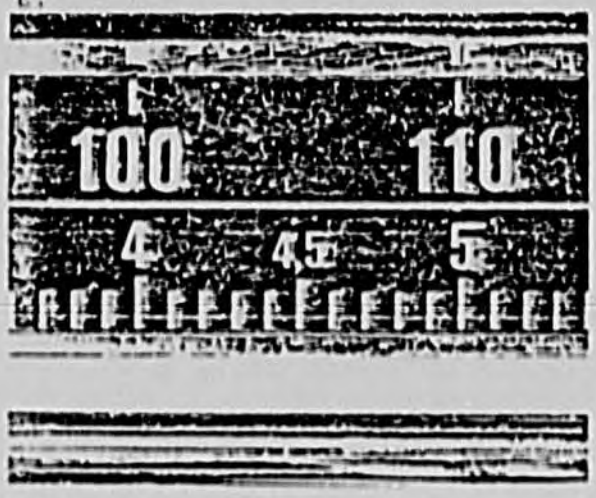


Upper Reading Area	This area is in multiples of 10: 0, 10, 20, 30 .... to 150 (see picture E). The upper indicator should lodge exactly in the slot (see pictures F, G, and H).
Lower Reading Area	
Numerals	Only the whole and half numbers are written on the scale (i.e. 0, .5, 1, 1.5, 2, ... to 9.5). Note that the 0 and multiples of 1 (1, 2, 3, 4, ... to 9) have larger than the half numbers.
Graduations	Linear graduations are of two different lengths (see picture E). The largest graduations are for whole numbers and half numbers and are so marked. Slightly shorter are the linear graduations for all other tenths. These are not marked with numerals.
Reading Procedure	When the indicator line on the sliding weight for the lower reading area points directly to a long graduation bearing a whole or whole and half number, record that result as no further procedure is required. When the indicator line points directly to a short graduation, count which line it is from the long numbered graduation to the left of it and record it. When the indicator line appears mid-way between fraction lines, e.g., between .1 and .2, record the linear graduation on the left. example: .1 or .2 ? - read .1 .4 or .5 ? - read .4 .8 or .9 ? - read .8
Practice Weight Reading	Photographs to permit practice reading are on page 20. There are 6 illustrated reading areas. The first two are read as follows: 1) Main indicator at 70 kg. Indicator line at 2.5 kg. Result = 72.5 kg. 2) Main indicator at 80 kg. Indicator line at 3.0 kg. Result = 83.0 kg.

E. Upper reading area-10 Kg increments
Lower reading area-.1 Kg increments

F. Main Indicator- Tip set too far to left

E.

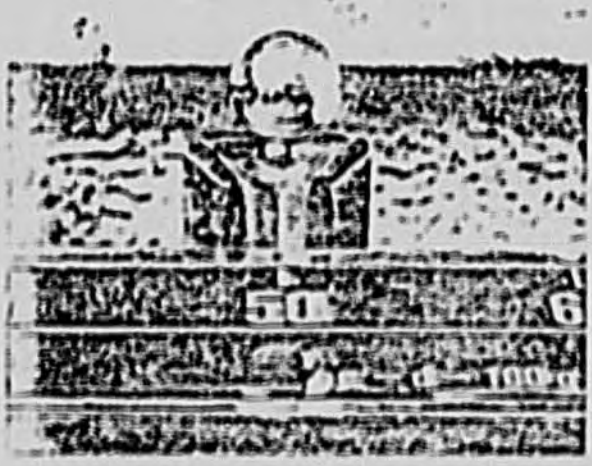


F.

G. Main Indicator- Tip set correctly in slot.

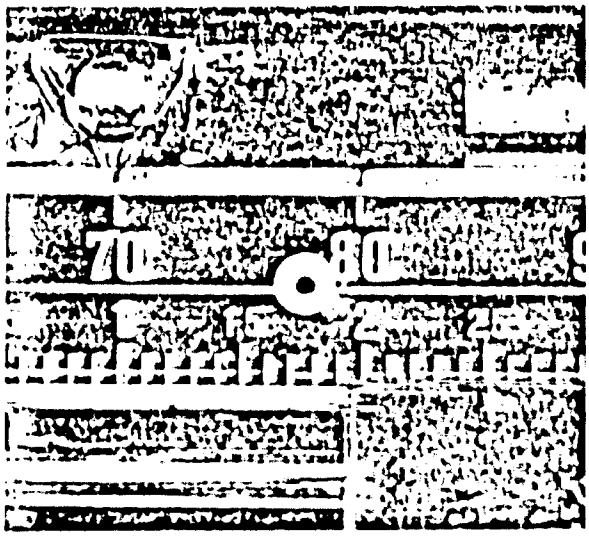
H. Main Indicator- Tip set too far to righ

G.

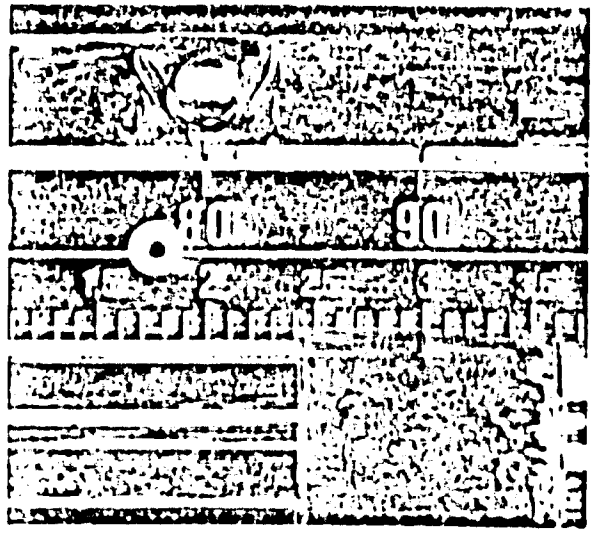


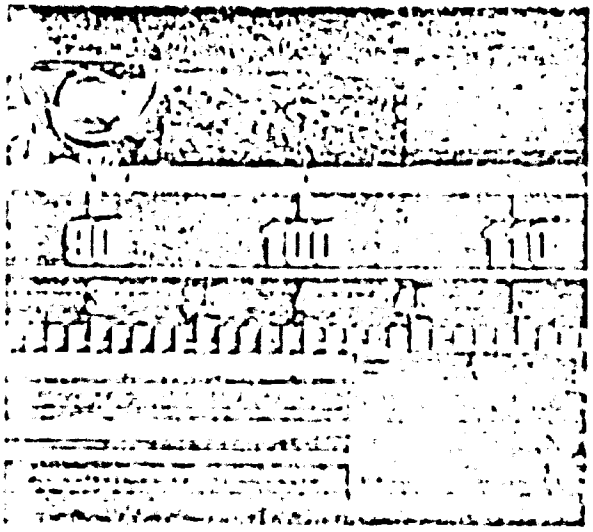
H.

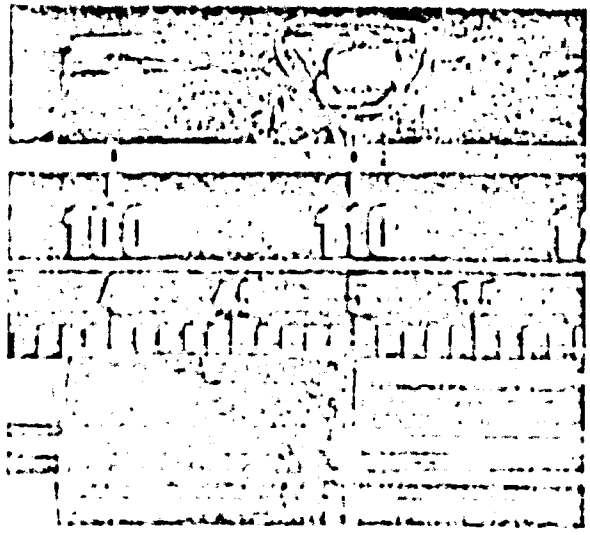
1.

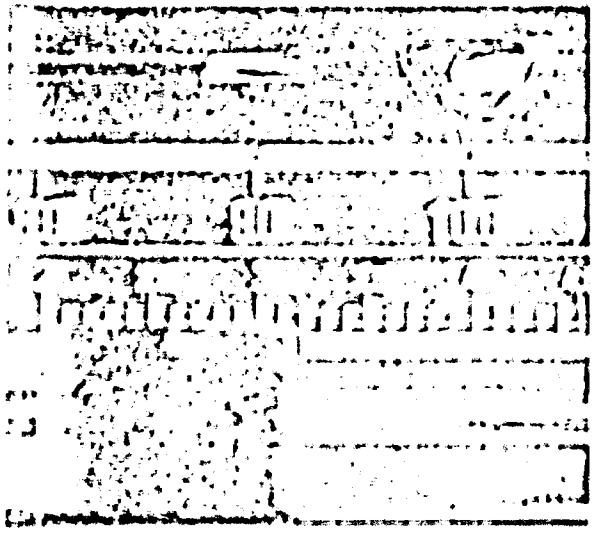


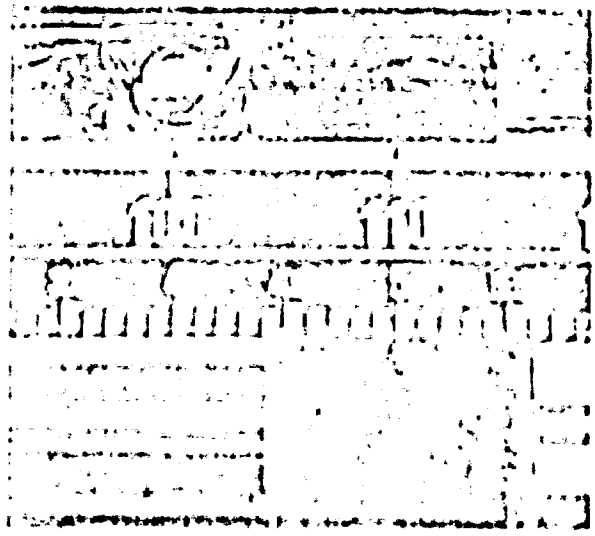
2.











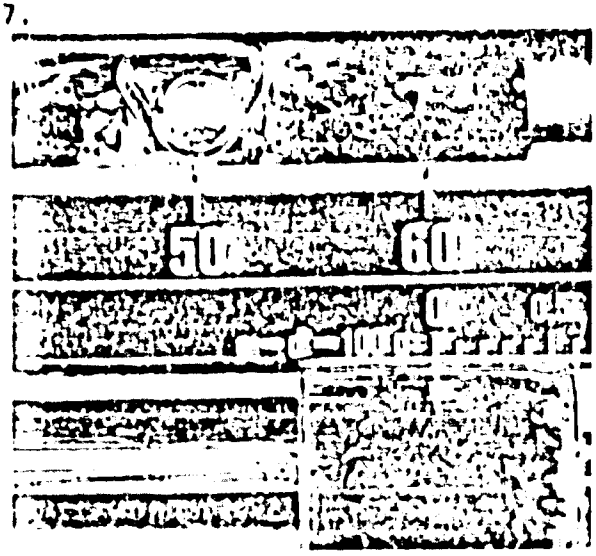
Now do the other four. (Wait 1 minute). The correct results are - 3) 94.8 kg; 4) 114.4 kg; 5) 102.6 kg; 6) 105.0 kg.

The second sheet is a similar test with 6 read-up areas marked 7 to 12. Do the examples in two minutes. Record the results and hand them in with your name at the top. The supervisor will mark them.

Answers to the second practice sheet are:

7) 50.0 kg
8) 70.2 kg
9) 93.3 kg
10) 82.5 kg
11) 82.7 kg
12) 72.0 kg

7.



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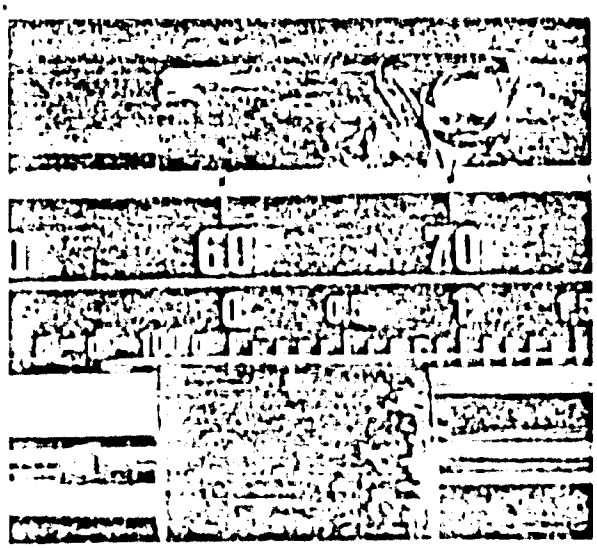
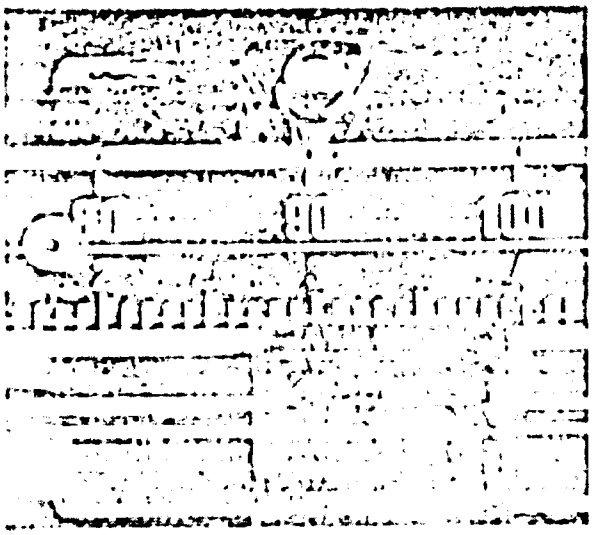
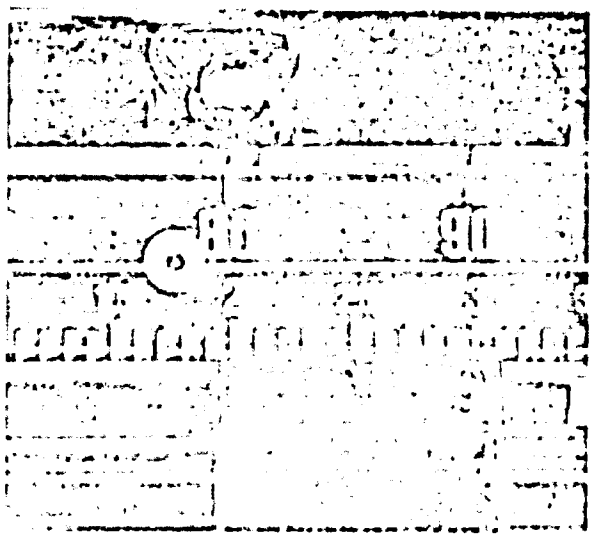
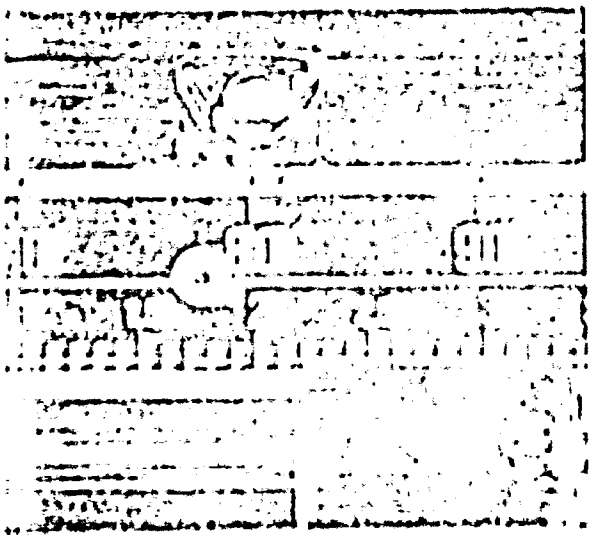


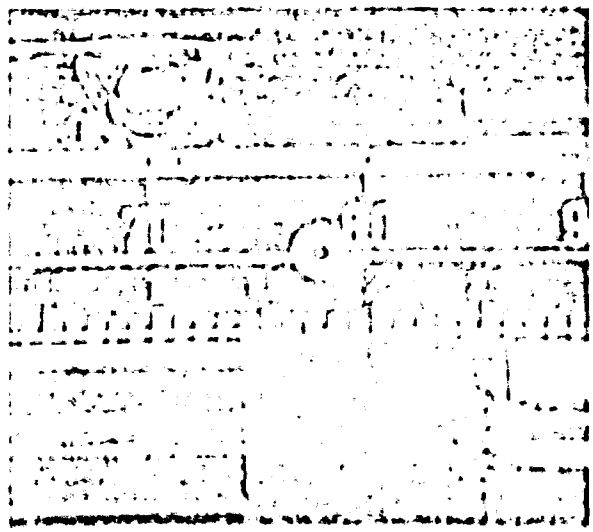
9.



10.







B. STEP-WISE PROCEDURES

Preparation	Have equipment ready. Accu-weigh Beam Balance scale, unlocked, with main poise and secondary poise set at zero, and tare weight adjusted to put beam in horizontal position (including basket or other items if infant is to be weighed). Measurement form, clipboard, and pencil; container for articles.
Prepare Subject	All footwear is removed (except for thin stockings). All coats, sweaters, and other heavy outer clothing are removed. All belts, glasses and heavy jewelry are removed and placed in container. If necessary, have subject empty pockets into container. Set main poise and secondary poise and tare weight at zero (for babies, set tare at 0 with basket on platform, including blanket or napkins used). Adjust knob until balance is horizontal. (Red arrows on scale should meet horizontally).
Instructions & Positions	Instructions for subject: "I am going to measure your weight very carefully and accurately. Please stand on the platform. Don't touch any part of the scale or anything else with your body, arms, or hands, and keep perfectly still throughout the weighing." Instructions for mother regarding infant to be weighed: "I am going to measure your baby's weight very carefully and accurately. Please place the baby, without any clothes on, in the basket that is on the scale. Stay near the baby so he/she will be comforted but please don't touch any part of the scale or the baby with your body, arms, or hands." Position the subject: Assist the subject to stand on the scale correctly. Demonstrate the ideal position if necessary. Repeat instructions as required. Check the subject's position: The subject is centered on scale without touching the scale or anything else.
Measurement	Estimate weight: Estimate roughly what the subject weighs according to the following usual weights for age ranges: Under 7 years: under or around 20 kilograms Eight to 11 years: 20 to 40 kilograms Over 12 years: 40 to 70 kilograms Measure subject: slide main poise indicator to the value of the lower end of the range of the estimated weight.

Slide 0.1 kg or secondary indicator to the right until the balance starts to tilt down. Adjust 0.1 kg indicator until balance is horizontal. (Red arrows on right side of scale should meet horizontally.) NOTE: If balance tilts down, scale weight is greater than subject's. If balance tilts up, scale weight is less than subject's. If balance is horizontal and level, scale weight equals that of subject.

Check balance: When balance is horizontal, check to ensure: subject is perfectly still and not touching scale or anything else with body, arms, or hands.

Check balance alignment: move -.1 kg indicator one small unit to right of set position. (Balance should tilt down). Move 0.1 kg indicator one small unit to left of set position. (Balance should tilt up.) Move 0.1 kg indicator back to set position. (Balance should be horizontal and level). Adjust, if necessary, repeating this step.

Record and check measurement: first read the main poise indicator at the point of its arrow, and call out the result. Next, read the 0.1 kg indicator at the point of its arrow and call out the result. Read the whole number first; then read the fractions next to the correct 0.1 kg (that are left of indicator).

EXAMPLE: Main indicator: measurer calls out "fifty". 0.1 kg indicator whole number: measurer calls out plus 5.2 kg". Have partner record the result and read it back to you. Look at the written result and cross-check it with that in the reading area. (If reading is not the same as that recorded, repeat this step.)

C. CRITICAL PERFORMANCE TEST

The critical performance test for weight will be done using the sheet on the next page.

D. SPECIAL PROBLEMS & ERROR CHECKLIST

Generally, the common errors of measurement previously covered in the height section apply to weighing procedures also. Those specific to weighing follow: Room cold; no privacy; scale not calibrated to zero; subject wearing unreasonable amount of clothing; subject moving on the scale.

CRITICAL PERFORMANCE TEST

WEIGHT

Date _____

Measurer _____

	1	2	3	4	5	6	7	8	9
1. EQUIPMENT READY									
2. SCALE ADJUSTED TO 0									
3. CLOTHING OFF									
4. INSTRUCTIONS TO CHILD									
5. POSITION ON PLATFORM									
6. ROUGH WEIGHT ESTIMATION									
7. MAIN INDICATOR									
8. .1 Kg INDICATOR									
9. BALANCE CHECK									
10. READING									
11. RECORDING/CROSS CHECK									
MEASURE RESULT									
SUPERVISOR'S RESULT									
DIFFERENCE									

COMMENTS _____

_____

_____

_____

Mark X in box if not done properly.

IV MID-UPPER-ARM CIRCUMFERENCE

A. EQUIPMENT

Design

It is recognized that various teams may have become accustomed to using different versions of plastic, fiberglass or steel tapes for measuring mid-upper-arm circumference. Tapes using metric measurement are preferred, and measurers may use those tapes with which they are already most familiar if they wish. However, once a particular type of tape has been chosen by a team, they must use that type of tape consistently throughout the project, and must record which type of tape they are using. Keep at least four tapes, in containers, with you, and keep two of them unopened to serve as spares until the first two become damaged or difficult to read.

If you do not already have a strong preference, we suggest that you use the Zerfas Insertion Tape Measure. This tape differs from conventional tapes in that it has a slot for insertion and a rectangular reading area. The insertion provides controlled tape fixation around the area. Figure 8 shows the insertion tape from different views.

One side of this tape measures the circumference (reading side, marked "cm"). The other measures the mid-point of the upper arm (mid-point side).

CARE & MAINTENANCE (Insertion Tape)

Packing

Roll the tape, starting with the free end and the reading side outermost. Place into the cardboard container, and close the lid. Packing should be done at the completion of every session.

During the session the tape may be left flat or hanging in a convenient place. Never put the unpacked tape in your pocket. It will crease or crush.

Problems of Wear and what to do

Creasing - flatten the crease area by bending the tape in the opposite direction. Excessive creasing or crushing (multiple creases for which the flattening procedure is ineffective) - replace the tape. Dirty tape (dropping in mud, etc.) clean with cloth and water, dry thoroughly with dry cloth or tissue.
Wet tape - dry with cloth or tissue paper. (Note that the curl of the tape, after it is removed from the container, will not interfere with accurate measures.)

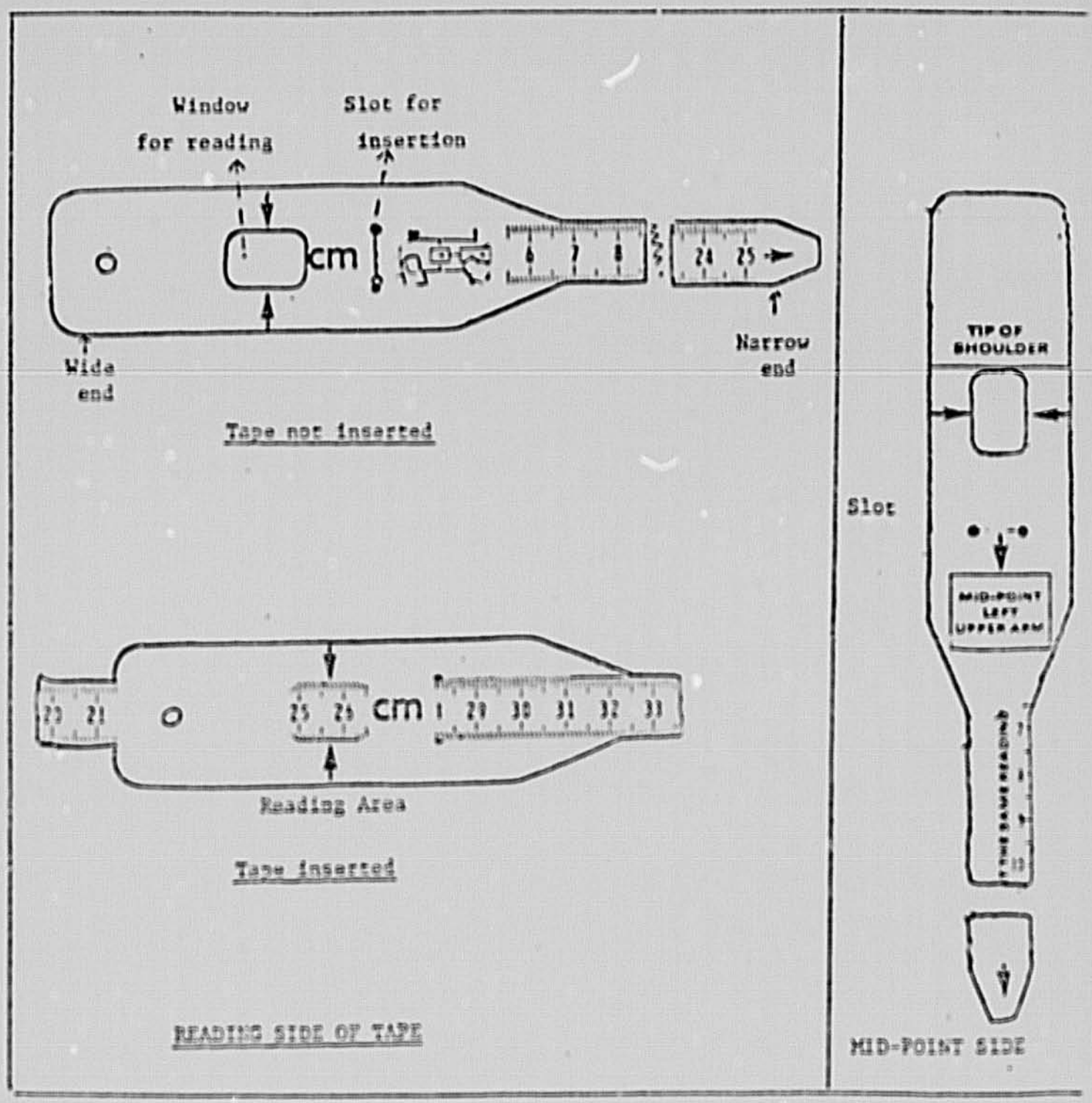


FIGURE 8 ZERFAS INSERTION TAPE.

Reading Areas

Upper arm mid-point: The scale at the left edge of the tape is read at the tip of the elbow. The same value on the right side of the tape marks the arm mid-point. (Note that the numerals on the right side of the tape are in actual centimeter lengths). See Fig. 9 for example.

Arm circumference: there are three graduation lengths. (See Figure 10). The longest indicates cm (centimeter) units, mid-length for ½ or 0.5 cm units, and for 1/10 or 0.1 cm units. Only cm unit numerals are indicated on the scale.

To read the arm circumference value, pay attention only to the window area of the tape. Look first at the point of the lower arrow. Check that it is aligned with the upper arrow point (i.e., pointing to the same graduation). If not, the tape is not centrally placed in the window and must be adjusted.

..Note the first cm numeral to the left of the arrow.
..Note whether a 0.5 cm unit is between the cm numeral and the arrow point.
..Count the number of graduations from the cm numeral (or 0.5 cm unit) up to and/or including the arrow point.
..If the point is between two graduations always read up to the graduation to the left of the point.

D. STEP-WISE PROCEDURES

Preparation

Have ready the Zerfas Insertion Tape or other tape, felt-tipped pen, and measurement form, clipboard, and pencil. See Figures 13-15 for illustrations of all of the following steps.

Instructions & positions

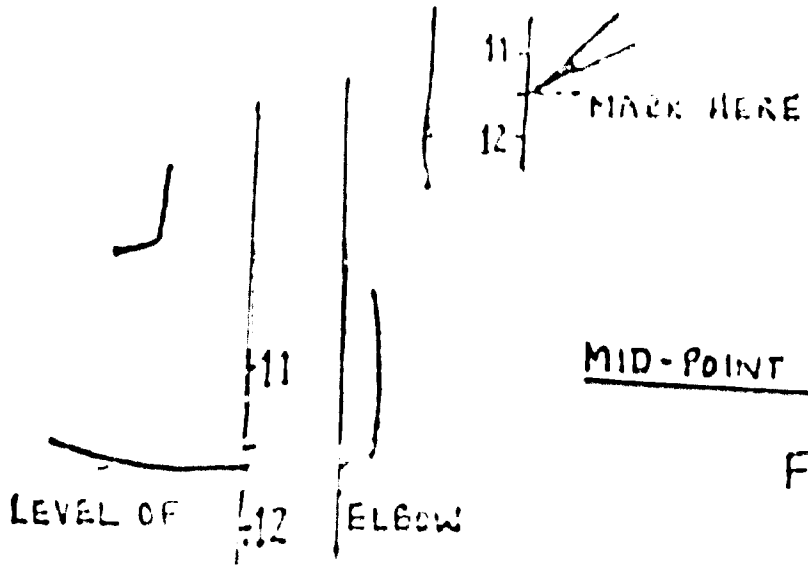
Give instructions to subject: "now, I am going to use a special tape to measure around the middle of your upper arm. First I will measure your upper arm to find the mid-point. Please bend your left elbow at a right angle and keep it that way until I ask you to straighten it. Please keep your left arm still."

Position the subject; assisting him/her to bend the arm correctly. Demonstrate the ideal position if necessary and repeat above instructions if required.

Position yourself facing the subject's left side. If subject is much shorter than you, you will need a chair to sit on.

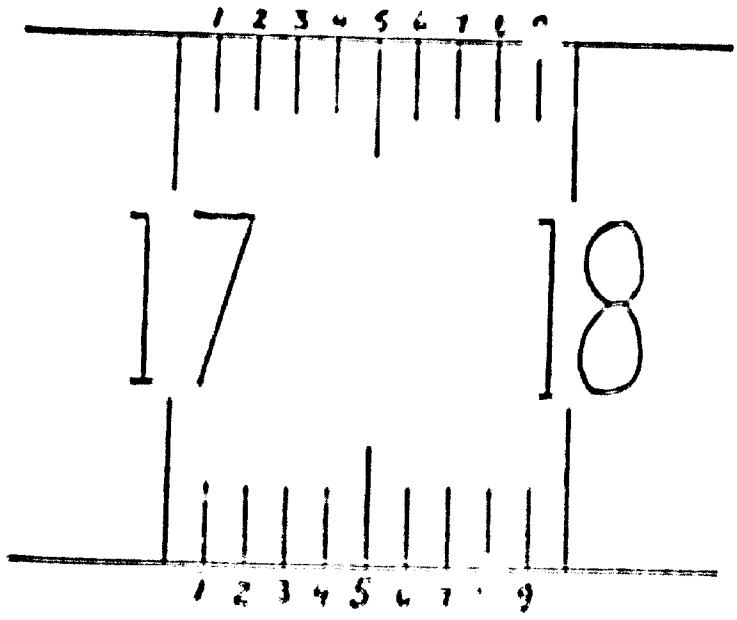
Finding upper-arm mid-point

To find mid-point of upper arm, identify the bony tip of subject's left shoulder with your left index finger, and



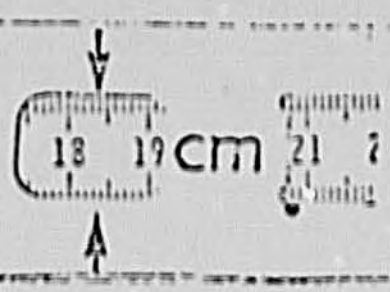
MID-POINT LEFT UPPER ARM

Figure 9

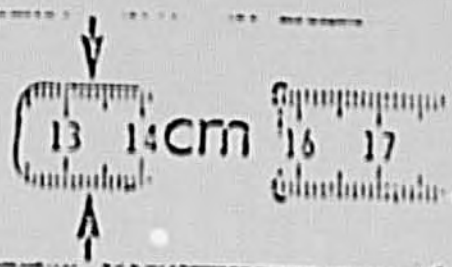


TAPE GRADUATIONS

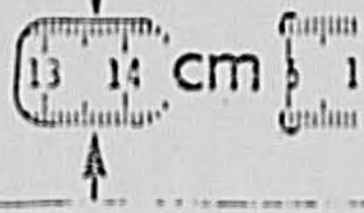
Figure 10



1. 1 8 . 4 (cm)

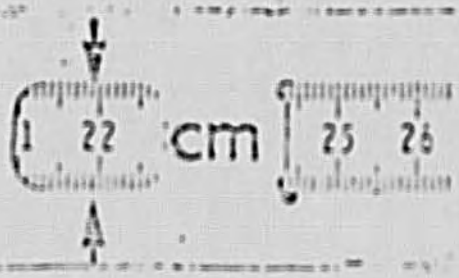


2. 1 3 . 3 (cm)

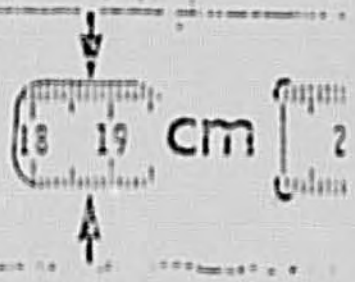


3. — — • —

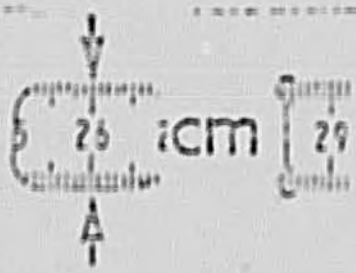
4. — — • —



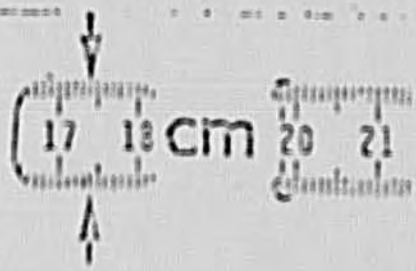
5. — — • —



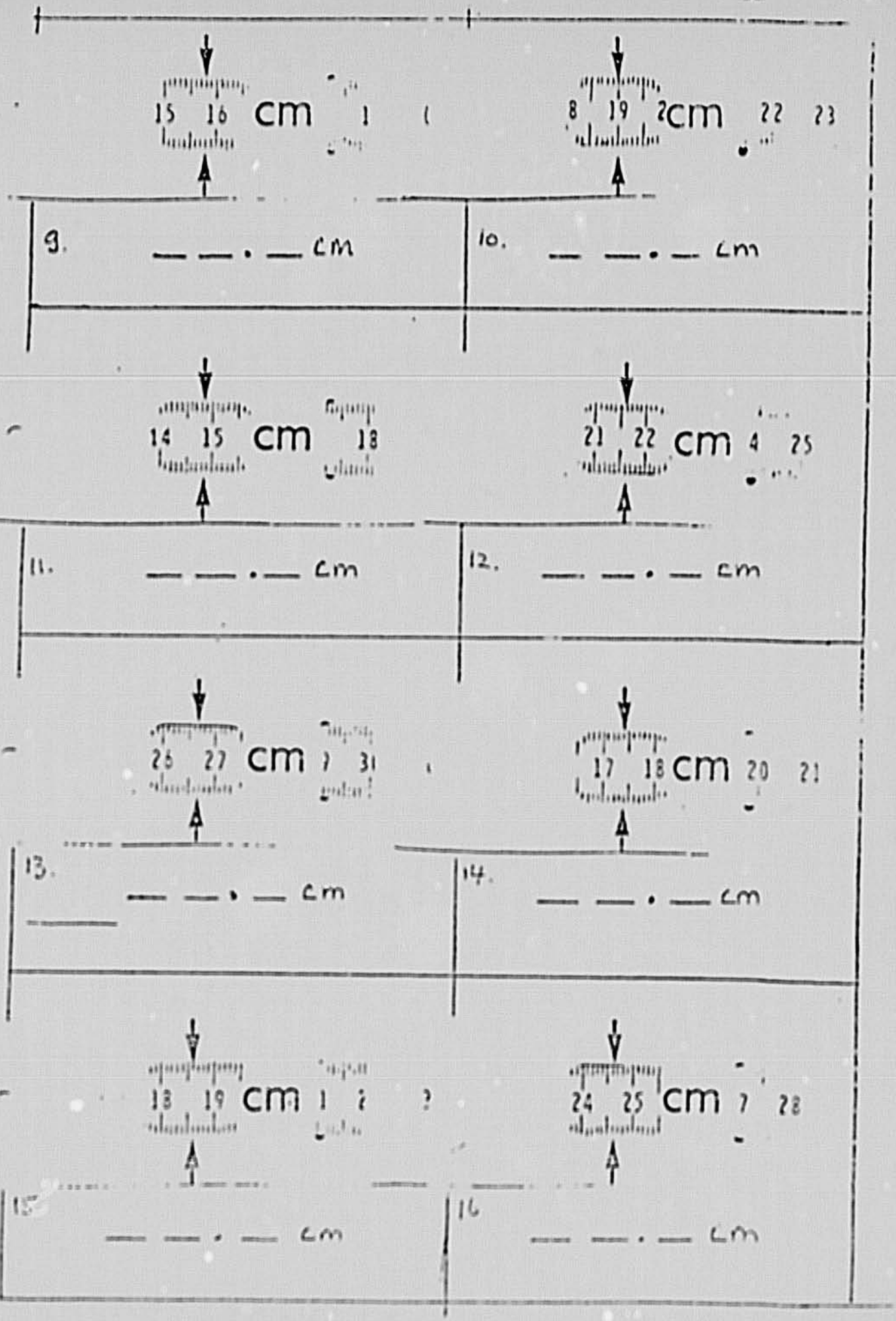
6. — — • —



7. — — • —



8. — — • —



READING AREAS - ARM CIRCUMFERENCE

mark it with your felt-tipped pen. Then arrange the tape so that the side marked "mid-point upper arm" faces you. Hold the wide part of the tape to the subject's shoulder so that your left index finger is over the tape window and is pressing against the same bony tip of the shoulder. Keeping the wide part of the tape in this position at the shoulder, hold the lower part of the tape with your right hand and stretch the tape straight down the arm. Support the tape against the arm with your left thumb. Using the scale at the left edge of the tape, note length (to the nearest half-centimeter) of the upper arm from the shoulder tip to the point of the elbow. Find this figure on the right side of the tape, and next to it, make a horizontal mark on the arm with the felt-tipped pen approximately ½" long. Pull tape away and check mid-point mark. (It should appear midway up the upper arm and at the widest part of the arm. If not, repeat this step, correcting the mark on the arm and the figure on the measurement form.)

Give new instructions to subject: "Now, please straighten your left arm so that it is relaxed and hanging down loose. Please keep your left arm still."

Measuring mid-arm circumference

Loop tape around subject's upper arm so that the opposite side of the tape (marked "CM") faces you. Thread the narrow end through the slot from behind so that the tape window faces you. Align the tape horizontally so that it covers the mid-point mark made previously. Support the wide end of the tape with the thumb and index finger of the left hand and pull the narrow end of the tape with the right hand until firm but gentle contact is made with the whole skin surface at the mid-point mark made previously. If skin wrinkles, tape is too tight. If tape slips, tape is too loose. Using thumb and index finger of your right hand, hold and fix adjusted tape near the slot. With the tape still fixed near the slot, check the tape to make sure it has perfect contact with skin surface. (Adjust if necessary, and recheck.) Grasp the free end of the tape with your left hand. In the window, read to the smallest graduation (that is, to the nearest tenth (0.1) of a centimeter) the figure where the two arrows meet. Call out the result to your partner. (Partner to [illegible] at reading area, record the result on the measurement form, and call it back to you.) Look at written result and cross-check it with that in reading area.(If reading is not the same, repeat this step.) Determine if subject appears either very fat or very thin and mark accordingly on measurement form.

C. CRITICAL PERFORMANCE TEST

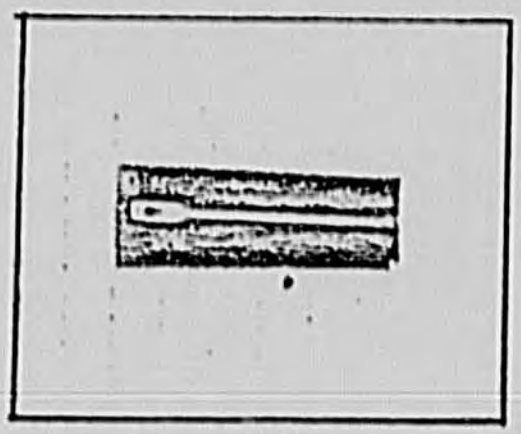
The form for the test on upper-arm circumference is found on pages 35-37.

D. SPECIAL PROBLEMS & ERROR CHECKLIST

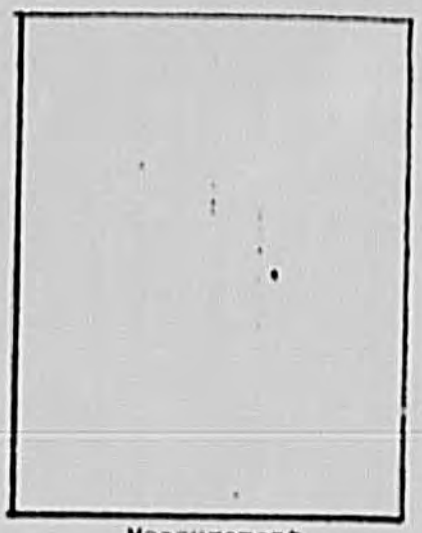
Tape too thick, stretched, or creased. Wrong arm (should be left arm). Mid-arm point incorrectly measured or marked; tape around arm, not at midpoint; arm not loosely hanging by side during measurement; tape around arm, not at mid-point; tape too tight (causing skin contour indentation or too loose (inadequately opposed), examiner not level with child.

MID-UPPER ARM CIRCUMFERENCE

HAVE EQUIPMENT READY:

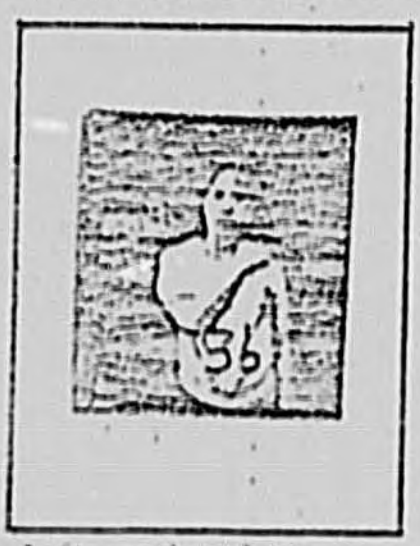


Zerfas Insertion Tape



Measurement
Form and Pencil

PREPARE, INSTRUCT AND POSITION STUDENT:

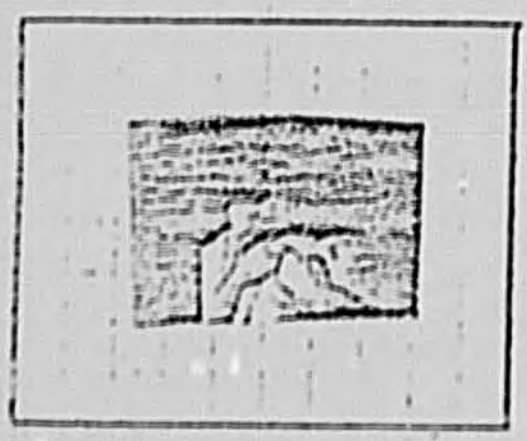


Left arm bared to
shoulder

Position yourself to
student's left side

Left arm bent

FIND MID-POINT:



Find bony tip of shoulder

Stretch tape down arm

Support tape with thumb

MID-UPPER ARM CIRCUMFERENCE (Continued)

FIND MID-POINT (Cont.):

Mark mid-point

Mid-point marked

MEASURE STUDENT:

Loop tape around arm

Thread narrow end through slot

Align tape and pull until firm

Fix tape at slot

Check tape around student's arm

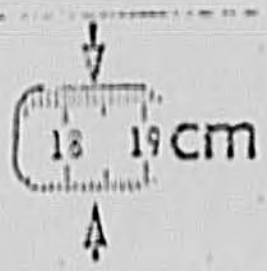
MID-UPPER ARM CIRCUMFERENCE (Continued)

MEASURE STUDENT (Cont.):

Tape too tight

Tape too loose

RECORD AND CHECK MEASUREMENT:



Read where arrows meet

Have partner check measurement

C. CRITICAL PERFORMANCE TEST

MID UPPER ARM MEASURE

Date _____

Measurer _____

	1	2	3	4	5	6	7	8	9
1. EQUIPMENT READY									
2. POSITIONING									
3. INSTRUCTIONS									
4. MID POINT TECHNIQUE									
5. MEASURE									
6. REPOSITIONING									
7. TAPE LOOPING									
8. TAPE AROUND ARM									
9. READING									
10. RECORDING/CROSS CHECK									
MEASURE RESULT									
SUPERVISOR'S RESULT									
DIFFERENCE									

COMMENTS _____

_____

_____

_____

Mark X in box if not done properly

V. QUALITY CONTROL

A. INTRODUCTION

Quality control with regard to anthropometry includes three components: 1) all measurers must be trained to an appropriate level; 2) all groups must use the same techniques; and 3) all groups must monitor measurer performance as well as the magnitude of inherent measurement error on an ongoing basis. This manual has so far addressed the details of methods necessary for each project to train its personnel appropriately. This section will provide information on techniques to monitor measurer performance and to accumulate data on measurement error which can be compared and reported across projects.

A simple approach to standardizing measurement technique is to supplement written protocols (such as this manual) with field training by and periodic checks against an agreed-upon "expert". The "expert" should demonstrate consistently meticulous technique (best shown by a Critical Performance Test), should show optimal replication of results not only at a current session but on a day-to-day basis, and should show agreement with reference experts or some other set standard. It would be desirable to have an "expert" designated for the CRSP in order to provide a standard for training and comparison of all field staffs. In addition, each project should designate its own internal "expert" (preferably someone who will be in the field most of the time) who should, at every opportunity, compare his/her techniques to that of the CRSP "expert".

Although the usual focus in training and checking is to minimize the error attributable to the measurer, field protocols should routinely check for and attempt to minimize other sources of error, including fatigue, carelessness, boredom on the part of the field staff; and subject attributes such as age, nutritional state, cooperation, styles, etc. Because of the presence of subject-related sources of error, field checks of measurer against the "expert" should include a wide range of subjects. Examiners should be expected to perform consistently on a similar wide range of subjects.

The general approach outlined herein is to follow a field protocol which includes: training of measurer; standardization exercise; critical review of raw data for probably sources of error; practice; retest, and periodic test for both intra- and inter-observer reliability and systematic recording and saving of results.

B. ZERFAS' STANDARDIZATION EXERCISE

(This will be used for intermittent field evaluation of examiner performance).

This exercise involved a single measurement of each type

being done (in this case, weight, height and mid-upper arm circumference) on a single subject by each examiner and by the expert. Obviously, as many subjects should be utilized as is practical to represent a reasonable range of variability in relation to the population being studied.

The tables on the following two pages represent a simple method for recording and evaluating differences between different examiners and the "expert". On page 43 is an example of results of a real trial. Criteria for passing or failing the test (number and magnitude of outliers allowed) should be agreed upon beforehand.

Evaluation of data focuses on the "difference" table. Characteristics to examine include: 1) sign test: does the direction (+ or -) of difference for any examiner random or systematic in relation to the expert? If it is systematic (for example, the examiner always or nearly always measures height taller than the "expert"), retraining is needed. 2) Number test: The amount of permitted deviation from the "expert", in absolute terms, should be pre-arranged. All measurements which differ by more than this amount should be circled, and special attention should be given to the technique of examiners who have large numbers of circled errors.

The same approach may be used in evaluation of intra-observer reliability, except that repeat measurements by the same observer form the basis for evaluation.

To maximize the benefits of test and review, a repeat exercise should be done within a few days if possible.

STANDARDIZATION EXERCISE RAPID METHOD EXPERT LEGEND _____

Measurement and Units _____ RECORDER _____ DATE _____

SUBJECT NUMBER

XAMINER	1	2	3	4	5	6	7	8	9	10
Expert										
d										
Expert										
d										
Expert										
d										
Expert										
d										
Expert										
d										
Expert										
Expert										
d										
Expert										
d										

Method

1. Fill in the Examiners numbers at the table margin. Note the expert's number will not be included.
2. Record the measurements of the examiners in the appropriate blocks.
3. Record the expert's measurements under that of the examiners for each child.
4. Subtract the expert's from the examiner's measurement for each child (d)
5. Copy the 'd' results into the difference table on the other sheet.

STANDARDIZATION EXERCISE (2) DIFFERENCES EXPERT KNOWN

DIFFERENCE TABLE (OF EXPERT VALUE FROM EACH EXAMINER)
OR OF EXAMINER MINUS EXPERT
OR FIRST MINUS SECOND MEASUREMENT

EXAMINER NUMBER	SUBJECT NUMBER 1	2	3	4	5	6	7	8	9.	10	Sign of CIRC.	Sign of ALL	Number more than ( )	( )	( )
1															
2															
3															
4															
5															
6															
7															
8															
9															
10															
Sign of CIRCLE															
Sign of ALL															
Number more than ( )															
( )															
( )															

Instructions

1. Copy the differences ' d ' into the above table, including the sign.
2. Circle heavily in black or in red all differences greater than whatever the sign.
3. Circle lightly in black or a color other than red all other differences greater than whatever the sign.
4. Total the number of these differences for each subject and examiner in the margins indicated.
5. When the number of circles in a row or column is 7 or less and they all have the same sign record this at the Sign of Circles margin.

   When the number of circles in a row or column is more than 7 if at least all but one of the circles have the same sign record this at the Sign of Circles margin.
6. Record in the same way under sign of all, for all measurement errors.

Evaluation of results (cf. further instructions for more detail)

Sign of circles - demonstrate bias according to examiner and/or subject.

RAW DATA — ARM CIRCUMFERENCE MARKED SITES EXPRESSED IN MM — SINGLE TRIAL — ATLANTA NOV 19 — 1

EXAMINER	SUBJECT NUMBER 1	2	3	4	5	6	7	8	9	10
Y.Mitchamm	1. 164	175	151	174	165	163	179	182	185	175
M. Miller	2. 167	177	152	176	163	166	169	183	184	171
. Cloth	3. 169	179	158	180	170	169	175	185	190	172
L. Mogan	4. 171	180	160	178	171	169	172	183	191	171
Dyme	5. 169	182	163	182	168	172	176	184	191	172
Stuart	6. 170	180	156	178	171	170	185	183	190	175
.Robbins	7. 171	179	156	181	169	171	175	183	192	177
tum	8. 178	185	161	185	170	174	170	184	193	170
.Brown	9. 167	181	155	183	170	169	174	188	195	173
EXPERT Team 1+2	165	176	151	175	162	164	174	182	184	173

PASS STANDARD

1. No mean bias more than 2.5 and no sum sq. more than 150
or 2. No mean bias plus sum sq. more than 5.0

COMMENTS

All examiners fail, with large +ve bias mean 3.8 to 6.3 mm. Similarity of error extent suggest a common cause of error- such as tape too slack.

The four errors of Ex. 8 exactly 10mm may indicate a reading problem.

Any child apart from 7, 8 & 10 would demonstrate errors on repeat testing. Check.

FUTURE Once problem identified and corrected, repeat trial with mid-point of arms not marked; and perhaps to include replicates.

DIFFERENCE TABLE (EXAMINER MINUS EXPERT)
Subject Number

EXAMINER	1	2	3	4	5	6	7	8	9	10.	SIGN TEST + Circles	SIGN TEST + Total	SUM DIFFS. Total	SUM DIFFS. Mean	SUM SQ.	S.D.	RESULT PASS/FAIL
3.	4	3	7	5	6	5	1	3	6	-1	3/3	9/10	+39	+3.9	207	2.5	FAIL
4.	6	4	9	3	7	5	-2	1	7	-2	4/4	8/10	+38	+3.8	274	4.0	FAIL
5.	4	6	12	7	4	8	2	2	7	-1	5/5	9/10	+51	+5.1	384	4.0	FAIL
6.	5	4	5	3	7	6	11	1	6	2	4/4	10/10	+50	+5.0	320	3.0	FAIL
7.	6	3	5	6	5	7	1	1	8	4	4/4	10/10	+46	+4.6	262	2.5	FAIL
8.	13	10	10	10	6	10	-4	2	9	-3	7/7	8/10	+63	+6.3	714	6.0	FAIL
9.	2	5	4	8	6	5	0	6	11	0	4/4	8/8	+47	+4.7	324	3.5	FAIL
SUM	40	35	53	42	41	46	9	16	54	-1	31/31	62/68	+334	+33.4	2435		
(EXPERT)	6	5	8	6	6	7	1	2	8	0			+48	+4.8	355	3.5	
SIGN CIRCLES+	3/3	2/2	4/4	4/4	5/5	4/4	1/1	1/1	7/7	0/0	31/31						
Diff.(E-EXPERT)	-1	-1	0	-1	1	-1	4	0	1	2	0/0	4/8	+ 4	+0.4	25	1.5	

C. RECORDING & REPORTING OF MEASUREMENT ERROR

Each project should keep data on replicate measurement under actual field conditions (after training of field staff). This will allow comparison among projects for intra- and inter-observer replicability of anthropometric measurements. To maximize the value of these data, they should be collected routinely throughout the period of the project and should include information from all examiners. Replicates within the same observer can be done by re-measuring every nth subject (preferably with a time interval of at least a few minutes). Replicates between observers can be routinely done at predetermined times (such as the end of each field day) by having the field "expert" remeasure a subject for each field observer. The tables which follow provide one type of form for keeping these data.

Data on inter- and intra-observer reliability can be analyzed within projects using the technical error of measurement* and coefficient of variations**, as has been done in other anthropometric studies.***

* $\sigma_e = (\Sigma d^2/2N)^{1/2}$

** 100

***See, for example:

Johnston, FE, PVV Hamill and S. Lemeshow. 1972. Skinfold thickness of children 6-11 years, United States. National Health Survey Series II #120, DHEW Publication #(HSM) 73-1602, National Center for Health Statistics, Rockville, MD., and Branson, RS, YE Vaucher, GG Harrison M Vargas and C Thies. Inter- and intra-observer reliability of skinfold thickness measurements in newborn infants. Human Biology 54:137-143, 1982.

Assistant: _____ Interobserver Reliability - Replicate Measures - Height in cm

Measurement#	Subject #	Time	Subject#	Time	Subject#	Time	Subject#	Time	Subject #	Time	Date	
											Month	Day
I												
II												
I												
II												
I												
II												
I												
II												
I												
II												
I												
II												
I												
II												
I												
II												
I												

Examiner: ____________________ Intraobserver Reliability - Replicate Measures - Weight in Kg

Measurement #	Subject #	Time	Subject #	Time	Subject #	Time	Subject #	Time	Subject #	Time	Date Month	Date Day
I												
II												
I												
II												
I												
II												
I												
II												
I												
II												
I												
II												
I												
II												
I												
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II												

Examiner: _____

Intraobserver Reliability - Replicate Measures - MUAC in cm

measurement	Subject #	Time	Subject#	Time	Subject#	Time	Subject#	Time	Subject #	Time	Date	
											Month	Day
I												
II												
I												
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I												

Interobserver Reliability - Replicate Measures- Height in cm

Examiners	Subject #	Time	Measure	Subject #	Time	Measure	Subject #	Time	Measure	Month	Day

Interobserver Reliability - Replicate Measures -Weight in Kg

[illegible]	Subject #	Time	Measure	Subject #	Time	Measure	Subject #	Time	Measure	Month	Day

Examiners	Subject #	Time	Measure	Subject #	Time	Measure	Subject #	Time	Measure	Month	Day
1.											
2.											
1.											
2.											
1.											
2.											