



## **KENYA CHILD NUTRITION PROJECT**





## **ANNUAL REPORT: 1999-2000**

### **Role of Animal Source Foods to Improve Diet Quality and Growth and Cognitive Development in East African Children**

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## **2. TITLE: ROLE OF ANIMAL SOURCE FOODS IN IMPROVEMENT OF DIET QUALITY AND GROWTH AND COGNITIVE DEVELOPMENT IN EAST AFRICAN CHILDREN**

### **3. NARRATIVE SUMMARY**

The accomplishments this third year included the successful completion of the controlled school intervention feeding and data collection in twelve rural Kenyan schools comprising ~525 first and second grade children in Cohort I, and the feeding and data collection for a second cohort of about 500 children. Activities included the quantitative preparation and daily delivery of three different types of feedings to the children during the nine months school was in session, continued collection of all measurements, and a follow-up collection of a third round of blood samples for micronutrient analyses, anemia and malaria status.

#### **Field Operations**

The office and field staff continued to function as a cohesive and high quality team under the Kenyan leadership of Professor Bwibo and Dr. Mukudi, and staff training was ongoing throughout

the year. The feeding of both cohorts has gone very smoothly despite the doubling of the number of children to be fed daily. The food preparation area doubled its cooking space, and extra food preparation staff was hired, thanks to leveraged funding.

Deworming was carried out for both cohorts in the 12 study schools on two to three occasions. Household health and sanitation talks were given to the parents at the time of deworming by a part-time project nurse and Professor Bwibo. Children with anemia were given a one month supply of iron tablets and referred to the health center for follow up, and children who were found to have positive malaria smears were also referred to the health center for treatment.

#### Data Collection

We completed data collection for the definitive Cohort I sample of twelve schools and about 525 Standard I students and their households by the end of July 2000. Data collection for Cohort II is ongoing.

Data collection in the past year was reduced for some areas. In reviewing the data from Cohort I, project statisticians and investigators noted that the variables changed little from month to month and that fewer data points per year would suffice. As of September 1999, data collection for most types of measurements (anthropometry, morbidity, 24-hour food intake recall) was cut back to every other month; and cognitive, activity, and behavioral measures were cut back to every other term.

An additional cognitive testing battery was given to all schoolchildren during the final term of feeding. It was comprised of dynamic tests as opposed to the conventional, static tests administered at five points during the study. Whereas static measures of cognitive skills quantify developed abilities, dynamic testing has the aim of quantifying the learning potential of the child during acquisition of new cognitive operations.

#### Data Management

The well-functioning data unit in the Embu office has entered, cleaned, and archived approximately 47,000 data forms collected during the year, with timely data transmission to UCLA. A copy of all Cohort I data is now at UCLA and analyses are in progress. Cohort II data is being steadily transmitted to UCLA in clean, edited form and archived both in Kenya and at UCLA. The consensus is that the data is relatively error free and there is little missing data.

#### Food Shortage

The most notable problem encountered this year has been a continuing food shortage in the past year due to drastically reduced rainfall and drought conditions. Because of the severe drought, food intake was measured monthly through December 1999 to better monitor the food situation. In addition, leveraged funds were made available to continue to feed the Cohort I children for another term until December 2000.

## **4. RESEARCH**

### ***A. Problem Statement and Approach***

The original problem statement defined the problem of poor diet quality with low micronutrient content among a rural African population with compromised growth and development of children. Among children, the proximate causes identified were little or no animal source foods (ASF) in the diet and low energy intake: poverty, inadequate knowledge of child feeding and poor household food security. Baseline biochemical analyses of the study children have confirmed poor micronutrient nutritional status and mild to moderate protein energy malnutrition. Poverty and poor availability and household access to animal source foods and low utilization were the barriers identified.

The problem statement suggested a two-phase sequence. Phase I consists of a controlled feeding intervention study of school children to test if animal source foods eaten daily at school by about 525 Standard I children (ages 6 to 9 years) improves their micronutrient status, cognitive function and school performance, attention, physical activity, health and physical growth compared to children who receive no feeding intervention. All feeding groups received the local dish *githeri*, a mixture of maize, beans and greens, but in addition one group received added meat; one group added milk and one added oil for energy. A comparison group received no school feeding and served as a control group. This latter group will receive compensation in kind after the research phase is completed. Thus between-child and inter-child comparisons will be possible.

This controlled intervention is of utmost importance, as the original observations of the beneficial effects of animal source foods on cognitive and school performance, activity and growth were based on non-intervention observational studies. Causality could not be ascertained, even with careful multivariate analyses, which controlled for relevant intervening and confounding variables.

A second cohort of 500 Standard I children has been enrolled from the same schools and will soon be completing the study. The intervention assignment and the data collection are the same as for Cohort I, the original cohort. Thus the same type of feeding is delivered to the study classrooms in each school and the control schools as before receiving no intervention feedings. Feeding the second cohort started in September 1999, has been carried out for three school terms, and will be completed in December 2000.

The doubling of the sample is desirable for several reasons.

1. Many repeaters were able to be fed with their own classrooms and did not have to be pulled out of class to be fed.
2. It is easier to do classroom observations, playground observations and school examinations if the whole class is being observed or tested.
3. Because small changes and differences are expected in the outcome measures over time, a larger sample size will make for more robust findings, should differences emerge.

A year of data analysis and write up will ensue in October through September 2001 under the GLCRSP. Findings will be disseminated at meetings and through publications. Based on preliminary findings, community and school interventions would be designed accordingly.

## **B. Progress**

In short, the project has completed the data collection for Cohort I after six terms of intervention feeding of school children in Embu, Kenya. A second cohort of ~ 500 Standard One children was added to the study in September 1999 following the procedures in place for Cohort I and data collection is being completed in December 2000, after four terms of feeding.

All the data collected for Cohort I has now been computer entered, edited and cleaned and transmitted to UCLA for archiving and analysis. The data for Cohort II has been partially entered as data collection will end in early December 2000. Completion of Cohort II data entry will be at the end of Feb. 2001. Data analyses for Cohort II will follow Cohort I.

We have been able to accomplish most of what we had planned to do in the third year of the study and have come close to satisfying our stated criteria for evaluation. However, there have been some exceptions where we have only partially met the criteria, as outlined below.

### Criteria for evaluation from the 1999-2000 workplan:

- Completion of intervention feeding and collection and entry for Cohort I – accomplished
- Costing of intervention feeding – in progress (see below)
- Completion of data collection – cohort I complete, cohort II (non GLCRSP) in progress
- Data entry, editing, cleaning transmission for cohort I – completed
- Laboratory work:
  - Round II (after one year of intervention) – completed
  - Biochemical Micronutrient analyses – completed for Round 2
  - Hematology (hemoglobin) – completed for Round 2
  - Malaria – completed for Round 2
  - Treatment carried out:
    - Those with  $\leq 7$  gm/dl of hemoglobin were treated with iron supplied by the project.
    - Deworming was carried out on all children on three occasions (twice for Cohort II)
    - Malaria cases identified by blood smear were treated
- Descriptive analyses – carried out up to visit 13 (March 2000) for morbidity and anthropometry
- Abstracts and presentations – several were given at scientific meetings (see below)
- Initial planning for intervention phase – in progress

The following activities have not been accomplished:

- The holding of review meetings to disseminate research findings and discussion of policy implications and recommendations. The PAC urged our team not to hold such meetings until data analyses are completed.
- The cost-benefit study by Dr. H. Ommeh cannot be completed until the study impacts and outcomes are known in 2001.

## **PROJECT ACTIVITIES CARRIED OUT 1999-2000**

### **1. Execution of Research Objectives**

The accomplishments of this third year included the successful continuation of a complex labor-intensive field study in Embu District; the operation of a data management and entry system;

ongoing staff training and standardization; quality control procedures for study measurements; and continuing analyses of data including biochemical micronutrients.

The above activities have continued smoothly, with the exception of several problems. The most notable problem has been a continuing and serious food shortage in the past year due to drastically reduced rainfall and drought conditions, and we have been monitoring the household food situation of the study households. Another setback has been that several head teachers have excluded children from school at various times because of non-payment of fees or *harambee* (self-help) contributions to the school fund. This has been reduced through meetings with teachers, head teachers and Ministry of Education officials. In addition, the control group households and classroom teachers have at times become somewhat uncooperative in regard to the study. However after meeting and home visiting with these groups cooperation has continued.

The research objectives are on target. Cohort I of ~525 children completed the sixth term and second year of intervention feeding on July 31, 2000. Because of the increasingly severe drought and food shortage, leveraged funds were made available to continue to feed the Cohort I children for another term, until December 2000. The only data collection will be a final round of anthropometry when the feeding ends. The children remained on the same type of diets they had received during the study.

The feeding of a second cohort of children, made possible by leveraged funds, has gone very smoothly despite the doubling of the number of children to be fed daily (~1000 children). Food is prepared centrally, quantitatively with excellent attention to sanitation, food safety and meticulous measuring of ingredients and weighing out of portions into each child's numbered feeding bowl. Leftovers of food are weighed and measured daily after each feeding session. The food preparation area doubled its cooking space, a freezer was purchased by donated private funds, and extra cooking, food preparation and cleaning staff were hired.

Biochemical analyses of the actual intervention diets for nutrient content have been carried out every six months. The micronutrient analyses for energy, fat, protein, and carbohydrates have been carried out in Kenya and the micronutrient analyses for iron, zinc, riboflavin, retinol, and phytate were done in the U.S.A.

**Staffing:** During the year we increased our data entry team in Embu. In addition, major staff changes occurred during Sept. 2000, at the very end of year III. Two senior nutritionists departed for graduate study in Europe (see below) and the field coordinator will be coming to UCLA to join the faculty (tenure track position) in Education (African) and the African Studies Center. All will use project data for their research, and all but one are Kenyan.

The office and field staff have continued to function as a cohesive, efficient and high quality team under the Kenyan leadership of Professor Bwibo, who spends 20% of his time on project matters both in Nairobi and Embu, and is always available by telephone and for meetings with the project senior team. He has also monitored the health problems encountered in the children, arranging for appropriate referrals and supervises the health aspects of the study. Dr. Bwibo has also been involved in community meetings and mobilization.

Dr. E. Mukudi, the departing field coordinator, is being replaced by Ms. Connie Gewa MSc, a senior field nutritionist who has been in charge of the preparation of the intervention feeding, recipes etc and all the food intake data collection. Mrs. Bett, a Master's degree candidate from the Applied Nutrition Program at the University of Nairobi has been hired as Ms. Gewa's replacement to cover some of the food intake and anthropometry data collection.

With the departure of Ms. Grillenberger, the data entry unit is now under the direct supervision of the most senior data entry person, who has been with the project from the start and thoroughly trained by Ms. Grillenberger. She is highly competent and consults freely with all the field scientists for any data questions and Ms. Gewa oversees her work.

### **Transportation**

The Toyota Landcruiser, contributed to the project by the Department of Pediatrics, University of Nairobi through the efforts of Dr. Bwibo for the cost of repairs, licensing and insurance (~\$2500) has been a very sturdy and reliable all-weather vehicle. The KARI Subaru wagon loaned to the project, through diligent care, a careful driver, and frequent repairs, continues its amazing performance for "short hops". The project-purchased Mitsubishi Truck has been the workhorse for daily school food deliveries and other field transport.

### **Field Activities**

The definitive Cohort I sample of twelve schools and about 525 Standard I students and their households completed the study July 31, 2000. An additional cohort of ~500 Standard I (Cohort II) students was enrolled, and baseline information was collected May-September 1999 and will be completed December 2000.

To make the data collection and entry manageable, as of September 1999, data collection for most types of measurements were cut back to every other month (anthropometry, morbidity, 24-hour recall, intake at home); and cognitive, activity, behavioral measures are now being done every other term. In reviewing the first year's data from Cohort I with the statistician and the investigators, it was seen that all the variables changed little from month to month and fewer data points per year would suffice. The only added data entry remaining is the completion of Cohort II data in Embu.

However, because of the severe drought in August 1999 to November 2000, food intake was measured monthly through December 1999 to better monitor the food situation. Unfortunately the drought and worsening food situation has continued, causing severe personal hardship among some households. Government and NGO food aid has only started to flow in the past two months with only severely affected households receiving relief food. The rains have finally appeared in mid-November 2000 and planting attempted once again. We feel the food shortage may affect the study results but the food intake by the children at home has been closely monitored.

During the final term of feeding, all schoolchildren will have received an additional cognitive testing battery that was comprised of dynamic tests as opposed to the conventional, static tests administered at five points during the study. Whereas static measures of cognitive skills quantify developed abilities, dynamic testing has the aim of quantifying the learning potential of the child during acquisition of new cognitive operations. In dynamic testing, there is an emphasis on measuring the psychological processes involved in learning and change and feedback is given

during the testing. It is thought by Dr. Sigman and others that dynamic testing should reduce educational inequalities, quantifying learning in action instead of just quantifying the existing set of abilities and level of knowledge. The six cognitive testers who administered the static cognitive measures at five points during the study were extensively trained in April 2000 in these dynamic testing techniques by Susan D'Souza, MA, who received special training. The dynamic tests were a syllogisms task and a sorting task. Testers were always instructed to ensure that the children understood what they were being asked to do. At the very start, if a child did not understand a task, the task was further clarified until he or she did understand it. After each pretest, the tester would indicate to the child that he or she did very well, but had made some mistakes. The tester explained that she would now show the child how to solve the problems to help the child solve them correctly. Testers became reliable with one another after one month of training, and completed the dynamic testing sessions on Cohort 1 of the sample in September 2000. The data are currently being entered and Cohort II testing is now being completed. It is hypothesized that children in the control condition will show significantly lower scores on the dynamic cognitive testing than children in the feeding conditions, even after controlling for socio-economic status.

Aside from the ongoing data collection, the following activities were carried out:

- Completion of data entry and transmission to UCLA for Cohort I;
- The food preparation and cooking building was expanded in order to accommodate food preparations for the second cohort of children.
- The intervention foods have been checked periodically for macronutrient and micronutrient content. Macronutrients (carbohydrate, fat, protein, moisture) have been tested in the Department of Food Sciences, University of Nairobi and micronutrients at Medallion Labs, Minneapolis, USA. Aliquots from each type of feeding were tested.
- Baseline studies for the new Cohort II included anthropometric status, food intake, cognitive performance, physical activity, classroom behavior, teacher ratings of children, literacy testing, a socio-economic survey and census of each household, and a two-monthly illness (morbidity) survey. Baseline health measurements included physical examinations and health histories, stool examinations for ova and parasites, and hemoglobin smears for red cell morphology and malaria.
- Repeat biochemical micronutrient status and hemoglobin and malaria smears were carried out on Cohort I in year III. Hemoglobin smears for malaria were repeated in July/August 2000. Because of the continuing drought (six missed rains) there has been less malaria reported clinically or found on thick blood smear exams. Specimens for Round three of micronutrient analyses are frozen and awaiting analyses in the next few months at the University of California, Davis in Dr. Allen's laboratory.
- Deworming for helminths was carried out in the 12 study schools on two to three occasions using a single dose of Mebendazole. Children with Giardia and Amoebiasis were referred to the Health Center for treatment. Also household health and sanitation talks were given to the parents at the time of deworming by a part-time project nurse and Prof. Bwibo. As for anemia, children were given a one month supply of iron tablets for anemia (with  $\leq 7$  gm/dl and below) and referred to the health center for follow up. Children who were found to have positive malaria smears were referred to the health center for treatment. Deworming was also performed on Cohort II as above.

## **2. Entry, Transmission and Archiving of Data**

The project's data entry unit has proved to be a well functioning, high quality unit housed in the Embu Office. The data entry unit staff is now comprised of a senior data manager with a diploma in computers and data management, three data entry assistants with diplomas in computers, and two part time data entry assistants with word-processing certificates. A Peace Corps volunteer has worked two days per week starting in January 2000 until September 2000.

An additional computer was purchased this year with outside funds, bringing the total to four tabletop computers, which, along with a printer, a photocopier and a data scanner, are all in full use for data entry. The scanner has continued to prove useful for numeric data such as food intake and recipes, anthropometry, socioeconomic data, and morbidity.

All Cohort I data is now at UCLA and analyses are in progress. Only data for Cohort II remains to be entered. Food intake data entry is moving along well, and is caught up. Data is being steadily transmitted to UCLA in clean, edited form and archived both in Kenya and at UCLA. The consensus is that the data is relatively error free and with little missing data. Please see Appendix 1 for a synopsis of data entry status as of September 30, 2000.

### **3. Dissemination Of Findings**

As with the data for Cohort I the baseline data for Cohort II results for anemia, anthropometry, malaria have been disseminated informally at several workshops and to the UNICEF country director and the Nutrition Division, Ministry of Health, Kenya. The Ministry of Education has been informed of the findings in more lay terms. Parents whose children were found to have severe anemia, malaria, or stool parasites were informed and a referral given to the local Rural Health Centre. Those with vision and hearing problems were also referred for evaluation and treatment. Any abnormal findings on physical exam requiring further referral and treatment of the children were discussed with the parents. Findings to date on the general health and nutrition status of the children have been shared with the teachers and head teachers.

The Ministries of Education, Health, and of Agriculture, on a district level, have been kept well informed as to the progress of the study and problems arising, as have the Federal Ministries- especially the Nutrition and Health Office and the Nutrition Division in the Ministry of Health. Cooperation and support by these groups have been excellent. As for the academic community, a MSc student from the Applied Nutrition Program of the University of Nairobi (Kabete Agricultural Campus) has been involved in a project since July 2000. She has measured pupillary dark responses as a measure of dark adaptation, a test developed at Johns Hopkins University (N. Congdon). A medical student (E. Schwietz) from the US trained her, and she has remained to work with the project as a field nutritionist.

### **4. Other Accomplishments**

Because of the drought situation, the food intake and anthropometry teams have been keeping close watch on the food intake of children and any weight losses, particularly in the more arid study areas. This has been done by tallying monthly food intakes of the children at home using hand-calculated calorie intakes and tracking weight changes. These observations have been going on since September 1999. The local chiefs and the Rural Health Center staff have been made aware of project households in distress, should emergency intervention become available. The

District and Provincial Ministers of Health and Education have been very interested in the above information.

We were able to feed and observe the original Cohort I through July 31, 2000. This gave us a full 6 terms of feeding and data. In addition, this cohort is being fed for at least one extra term because of the severe food shortage, through November 2000, but no data collection is being carried out.

## **5. GENDER ANALYSIS**

As stated in the previous annual report, the project at all levels is predominantly staffed by women. This came about largely because most nutritionists and people trained in child development and health are women. Many of the women were trained in the previous CRSP study and wished to be working once again to earn income of their own. Women also enjoy working with the young school children, and are more comfortable with the home visiting aspects, wherein they obtain information on food intake and illness. The following personnel are women:

Senior level: Principal and Co-Principal and Co-Investigators (C.G. Neumann, S.P. Murphy, M. Sigman, L.H. Allen). These are all senior level faculty at the University of California (UCLA and Davis) and the University of Hawaii (S.P. Murphy).

The field coordinator, Dr. Edith Mukudi, a Kenyan woman, received her Ph.D. from SUNY at Buffalo in Education Development with a minor in Nutrition in 1998. Her dissertation research dealt with the interrelationship of "Education Achievement and Nutrition in Rural Kenyan Children". She holds a teaching appointment of Lecturer at Kenyatta University in the Department of Education. She is also appointed as a Post-doctoral Scholar at UCLA. She remained with the project until Oct. 2000.

The senior field staff who are resident in Embu are all women, and with one exception are all Kenyan. Three hold Masters and one a Bachelor's degree. Three are nutritionists and one is a psychologist/educator and all but two were educated in Kenya. The nutritionists are C. Gewa, R. Ngaruro, M. Grillenberger (Germany) and the psychologist is M. Kamore. One of the Kenyan Nutritionists who is the Embu District Nutritionist (R. Ngaruro) was seconded to the project for its duration by the Ministry of Health. A Community Field Nutritionist was seconded to us as well to act as a supervisor for the Food Intake enumerators. A new team member is a Masters of nutrition candidate from the University of Nairobi. She is doing her research with the project.

We felt it important to recruit as many Kenyan women as possible who would assume senior positions of leadership in the University or the Government of Kenya as part of infrastructure building. The field coordinator and senior investigators also provide excellent role models and mentoring for the younger scientists who wish to carry out doctoral studies. We also have a postdoctoral scholar from UCLA (S. Whaley) who has divided her time between UCLA and Embu. These young women also serve as role models and mentors for the Kenyan staff.

Dr. Charity Kabutha, well known in gender issues, especially in Women in Leadership in Agriculture, has been a consultant to the project. Dr. Helen Ommeh, an agricultural economist with the University of Nairobi, College of Agriculture, worked on the planning grant and

continues as an occasional consultant and will do a simple cost-benefit analyses of the feeding intervention portion during this year.

Most of the field workers and supervisors are village women and are learning to bank and save their salary money. They are proud of their training and carry out highly responsible work. The schoolteachers and many head teachers (principals) at the study school are predominantly women as well, although they are not compensated by the project.

## **6. CONTRIBUTIONS TO POLICY**

Although there has been a great deal of informal and small group discussion in nutrition, health, education and NGO circles about policy issues, formulation and analyses relevant to our study, no formal meeting was held in the previous project year being reported on. This has been delayed until mid 2001 when the analyses are completed and the study results known. However, the participant list had been selected, the preliminary agenda set, and a venue chosen. Using funds from UCLA Office of International and Overseas programs, we have hired a part time meeting coordinator, Ms. C. Nyaga, recently retired from the Ministry of Health, Eastern Province Office of School Health and Nutrition. Ms. Nyaga is trained both in Education and Nutrition and is very experienced in school feeding efforts, working in the past with the World Food Program's School Feeding Program.

Data analysis is just beginning to get underway and the definitive findings are not yet known. Nonetheless even at this stage, the project has already stimulated policy considerations by the GLCRSP, the World Bank, BASIS CRSP, ILRI and Heifer Project International. By studying human health, growth, and cognitive development in relation to diet quality improvement through increased intake of animal source foods, the livestock, education and health communities have begun to consider a linkage of livestock production with improvement of human well-being and nutrition as one of the outcomes or impacts of improved livestock production. Increasingly the above – mentioned groups are viewing human health and nutrition improvement as a desired positive outcome. Groups such as Heifer Project International (HPI), ILRI, and some of the other CRSPs have invited the P.I's and others in our group to speak about such linkages and the evidence for the role of animal products in improving diet quality and human function at their meetings. Much attention has been paid to the role of animal source products and micronutrients in growth and development, and as economic capital investment. Also the PI was invited to an IAE Annual Conference in Germany at Berlin and at an IFPRI sponsored meeting in Hanover to address the same topic.

By working closely with the school administrators, local physicians, parents and community leaders, there has been awareness raising of the need for school feeding and its improvement, particularly for young school children. Children often come long distances to school without having eaten, and teachers and administrators are becoming very concerned about this. Lack of food, poor nutritional status, and poor health interfere with the children's ability to benefit from their educational experience.

The health assessment activities of the children in this study have a high visibility, with parents accompanying their children and watching a health professional examining their children. They get feedback and see their children being checked for anemia, malaria and intestinal parasites, and

receiving de-worming medication at school and learning how to prevent parasites. These activities introduce the community to the concept of the role for schools in health and nutrition services and community improvement. A food-based, rather than pharmaceutical approach, is being used to improve the micronutrient content of the diet. Foods available in the community are being used for the school feeding.

Lastly, with increasing vegetarianism and “fear of red meat” in the USA, groups dealing with children have expressed great interest in our research.

Thus the study already is and will further call attention to the following policy issues:

- I. Food-based solutions to micro nutrient deficiencies; particularly for zinc, iron, vitamins B<sub>12</sub> and A, and calcium through the use animal source foods.
- II. The potential role of animal source food nutrition in learning and cognitive function: If the large investment in primary education is to realize a return, the children must be in the best condition to learn. Successful students go on to higher education and become future leaders contributing to social and economic development.
- III. The prevention of anemia through school-based feeding (and de-worming) will make increased physical work possible and increase the activity and learning of the children.
- IV. Serious policy constraints that must be addressed include a lack of resources for any sustained school feeding programs.

## **7. OUTREACH**

Outreach efforts on a community-wide basis will await completion of the research when results are known. An immediate and limited goal however is to assist the community in continuing school feeding that is affordable and sustainable after the study is completed in the field. Major collaboration involving the families, teachers, school administration and communities, women's groups, NGO's, and agricultural, home economics, and nutrition and health extension services will be needed.

Our vision for future outreach and extension is to emphasize community and school partnership in procuring or producing food for the feeding of toddlers and school children. Should the research findings support the advantages and “added value” of meat or other animal source foods in the diet, there would be opportunity for NGO's involved with livestock and other small animals to become involved in micro-enterprises involving particularly, but not exclusively, women. They would assist households in obtaining and maintaining animals for household consumption, particularly by the children and for preservation for future use and for income generation. Parents, children and schools could be involved on the production side through 4H-like efforts. Intensive and practical health and nutrition education of a participatory and practical nature would be needed for families and school personnel through extension services of the Ministries of Health (Nutrition) and Agriculture.

As of now the main outreach activities have been the continued feeding of cohort I children for the fall term (through December) because of the drought and food shortage in the area. Several lectures on household sanitation in the prevention of Giardia and Amoebiasis which are not affected by deworming with Mebendazole were given to the parents.

## **8. CONTRIBUTIONS TO DEVELOPMENT**

### ***A. Contributions to U.S. Agriculture and Nutrition Policy and Practices***

Iron deficiency and, to a lesser extent, zinc, vitamin B<sub>12</sub> and calcium deficiencies are problems in the USA, particularly among poorer families in inner cities and in rural areas and among strict vegetarians and groups who have drastically reduced meat in their children's diets. The less severe cognitive deficits associated with iron deficiency, poor linear growth associated with zinc deficiency, and neurological development problems associated with vitamin B<sub>12</sub> need to be addressed in American children as well. The potential findings of our study would address problems and approaches to prevent micronutrient deficiencies in the U.S.A. and counter the groundswell of negative information and "press" against inclusion of meat in the diet in moderate amounts including fowl and fish. This may contribute to a modest increase in meat and other animal food consumption, particularly for children.

### ***B. Contributions to Host Country***

The development target is to improve the ability of children to learn, to benefit from their school experience and to enjoy better health. This will enhance their ability to contribute to leadership roles and social and economic development of their community and nation. Kenya spends over a third of its budget on education. Better-nourished children who are not iron deficient or suffer other micronutrient deficiencies will learn better, be more physically active and in better position to learn and increase the returns on Kenya's heavy investment in education. In addition to cognitive and school performance we anticipate improvements in physical growth and reduction of anemia which will increase ability to perform physical work and therefore contribute to economic development.

Should the study results of the controlled intervention study establish a causal relationship between intake of animal foods and the child's cognitive function health and growth, this would contribute immeasurably to policy in multiple areas - education, nutrition and health, agriculture, and economics and the importance and necessity for school feeding.

### ***C. Linkages and Networking***

Interaction with the other East African GLCRSPs projects through the common goal of nutrition improvement has been mainly at Annual Review meetings of the GLCRSP. The outcome of improvement in human health and nutrition through enhanced livestock production is a shared theme with ILRI. The BASIS CRSP and IFPRI invited the PI to give a paper at workshops in Addis Ababa and in Germany sponsored by these groups. Our project does interact with Makerere University Child Health and Development Center in a shared related project. This deals with rabbit production for household consumption to improve diet quality, child growth and food security.

## **9. OTHER CONTRIBUTIONS**

### ***A. Support for Free Markets and Broad-based Economic Growth***

Stimulation of small animal production, production of milk and local foodstuffs for school feeding, and family diet improvement support income generation and the marketing and sale of the above foodstuffs. The field staff now banks their salaries and controls the use of their money. Some have started small businesses with their savings in their spare time.

### ***B. Contribution and Compliance with Mission Objectives***

Our project goals and objectives are consistent with the 1998-1999 revised strategic framework of USAID Agency Goal #4: “World Population Stabilized and Human Health Protected”, and specifically REDSO/ESA Strategic Objective #4, that of “Improved Child and Reproductive Health Systems in East and Southern Africa”.

In the context of improving diet quantity-quality and growth and cognitive development and health of children, our project will strengthen the following areas:

IR4.1 Strengthening of information networks and improved policy

IR4.2 Improving technical capacity of partners in nutrition assessment and promotion.

IR4.3 Improving policy in the area of food based micronutrient approaches. Importance of school feeding in relation to enhancement of cognitive function and learning.

IR4.5 Improving family diet quality through incorporation of animal source foods, particularly for your children, schoolers and women of reproductive age.

### ***C. Support for Democracy***

This project promotes democracy in several ways:

1. The highly interactive and participatory style of operation of the current Research Team has set the tone for the project. Decisions are mainly by majority vote or by consensus and all experience “democracy in action.”
2. In the future intervention phase:
  - Women will obtain experience in leadership skills and be given hands-on experience in the processes of electing leaders and representatives and use the concept of majority rule. They will experience democracy. Also, through potential involvement in credit, savings, and investing they will be introduced into private enterprise.
  - Improved food security, nutrition, and income generation allow community members to obtain better health and to become more active and creative participants in their communities. This leads to increased political stability, which fosters participation in community governance

### ***D. Concern for Individuals***

Children who have severe anemia, malaria or any other serious condition have been referred for medical evaluation and treatment. All children receive anti-helminthics (deworming) as hookworm and ascaris infection is present. Children have all had physical examinations and health histories taken and those with problems are referred for further evaluation and care. All children are having vision and hearing tested and those with problems are referred for further care.

### ***E. Humanitarian Assistance***

Many school children in the study appear to come to school hungry. The school feeding is most welcome and is the only substantial food some children receive prior to or during the school hours. After the informal study ended for cohort I, school feeding at school was continued for another term because of the drought and severe food shortage.

## **10. LEVERAGED FUNDING AND LINKED PROJECTS**

We received a supplement to our National Cattlemen's Beef Association grant for an additional \$60,000 to continue feeding a second cohort of children. This brings the two-year grant total to \$210,000.

Modest funds continue to be leveraged from UCLA: The International Studies and Overseas Program Office and private various donor funds at UCLA. Dr. Neumann has received several travel grants of about \$2000-\$3000 to visit the field site and supported planning of an upcoming policy steering committee meeting. The Academic Senate at UCLA granted modest funding (\$1,200) toward the pupillary response test for vitamin A deficiency.

Additional leveraged funds include \$6,400 for biochemical analyses and shipping of blood samples from ILSI/OMNI as part of a larger study that is being carried out by Dr. E. Gershwin at UC Davis.

A Thrasher Foundation supplemental grant for \$9,500 was received for work up to Jan 31, 2001, for a community intervention in Uganda entitled "Community Intervention to Improve Diet Quality for Children through Household Rabbit Production and Consumption in Rural Uganda: Food-based Approaches to Preventing Micronutrient Malnutrition". This brings the total grant to \$32,500. The project entails a community-based approach to increase animal source food intake by households through rabbit raising. This project targets women and children in Uganda, and is a collaboration with Dr. Jitta of Makerere University's Child Health Development Center and College of Agriculture, and a Ugandan NGO, VEDCO. This NGO has already introduced rabbits into communities in Lowero District through women's credit groups, with a focus on income generation. Nutrition education components consist of hands on demonstrations, participatory education, and recipe development to increase meat intake of the households, particularly of women and children. This project addresses diet quality improvement through increased meat in the diet, food security and in the future income generation by and for women. Impact will be evaluated by nutritional food intake and economic indicators.

Still pending is a possible grant from the Child Survival Office of USAID.

## **11. TRAINING IN PROGRESS IN THE NEXT TWO YEARS**

One disappointment this year was not being able to leverage more funds than we have to date for training purposes. Because of the limited funding, we were not able to make any commitments for graduate training for our senior staff, two excellent doctoral candidates, and one Master's level candidate in Community Nutrition. All plan to use project data that they were involved in collecting for doctoral and master's dissertations. They are being funded by non-project funds (in part by the P.I.) and by their personal efforts and scholarships from the UK and from the Dutch government.

<u>Name</u>	<u>Expected Degree</u>	<u>Year</u>	<u>Discipline</u>	<u>Institution</u>
C. Gewa**	Ph.D.	2003-4	Nutrition	UCLA or Cornell
M.Grillenberger	Ph.D.	2003	Nutrition	Wageningen U. Holland
M. Kamore*	Ph.D.	2003-4	Psychology	U. of Lucknow, India
R. Ngaruro	MSc	2002	Public Health	London School of Hygeine & Tropical Medicine, UK
J. Siekmann	Ph.D.	2001-2	Nutrition	U.C. Davis

\* proposed - not yet admitted.

All of the above will carry out or use project data for their dissertations.

A great deal of training and retraining has gone on of the field enumerators and supervisors. Over fifty have been trained in various areas of food intake, anthropometry, cognitive testing and observations, censuses, morbidity, socioeconomic status, literacy testing, computer and data entry. These are marketable skills for future research or evaluation positions or in relevant ministries.

## **12. COLLABORATING PERSONNEL**

<b>Name</b>	<b>Country</b>	<b>Telephone</b>	<b>Fax</b>	<b>E-mail</b>
Allen, Lindsay H. UC Davis	USA	916-752-5920	916-752-3406	Ihallen@ucdavis.edu
Bwibo, Nimrod O. U. of Nairobi	Kenya	254-2-720947	254-2-566305	cnpembu@africaonline.co.ke
Jitta, Jessica Makerere Univ.	Uganda	256-41-541684	256-41-531677	Torch@imul.com
Mukudi, Edith Kenyatta Univ.	Kenya	254-161-30402		cnpembu@africaonline.co.ke
Murphy, Suzanne P. Univ. of Hawaii	USA	808-586-2987	808-586-2982	suzanne@crch.hawaii.edu
Ommeh, Hellen U. of Nairobi	Kenya	254-2-726040	254-2-441831	karcc@arcc.or.ke
Kogi-Makau, W.	Kenya	254-2-630408	254-2-631004	anp@arcc.permanet.org
Semenye, Patterson	Kenya	254-2-631452	254-2-630818	semco@AfricaOnline.co.ke
Shako, B.	Kenya	Kenyatta Hosp.		
Sigman, Marian	USA	310-825-0180	310-825-0340	msigman@ucla.edu
Whaley, Shannon	USA	310-794-4100	310-825-2682	swhaley@ucla.edu
Zimbe, Imelda	Uganda	256-41-541684	256-41-531677	torch@imul.com

## **13. COLLABORATING INSTITUTIONS**

University of Nairobi                      Pediatrics, School of Medicine  
Department of Food Science, Applied Nutrition Program  
College of Agriculture

Ministry of Health                      Nutrition Division @ Central and District Level  
Ministry of Education                  Office of Child Health and Nutrition Central and Provincial Level  
Makerere University                    Kenya Agriculture Research Institute - Nairobi  
Ministry of Agriculture                Heme Economics and Livestock Central and District Office

## **14. PUBLICATIONS**

There were no project publications this past year.

## **15. PRESENTATIONS AND ABSTRACTS**

### 1. Invited Presentations

- N.O. Bwibo and C.G. Neumann, “Animal Products and School Performance in Kenya (GLCRSP Project)” BASIS CRSP: Horn of Africa Regional Workshop, Addis Ababa, Ethiopia; November 3-5, 1999
- C.G. Neumann, “Implications of the rise in Livestock Product Consumption for the Nutrition and Health of young children in Developing Countries” Expo 2000 Workshop on Sustainable Animal Production and World Food Supply. Hanover, Germany (School of Veterinary Medicine and IFPRI).
- C.G. Neumann, “Role of Animal Source Foods in Improving Diet Quality and Micronutrient Content; Contribution to Child Health, Growth and Development”, XXIV International Conference of Agricultural Economics, Berlin, Germany, August 13-18, 2000. (IAAE, IFPRI and ILRI).

### 2. Abstracts (please see Appendix 2)

- Seikmann, J., Neumann, C.G., Allen, L.H., Bwibo, N.O., Murphy, S.P., and Mukudi, E. Intervention with animal products in Kenyan schoolers; impact on micronutrient status and interactions with malaria. Experimental Biology 2000, San Diego.
- Whaley, S.W., Daley, T.C. “IQ on the Rise? The Flynn Effect in Rural Kenyan Children”, submitted for SCRD Conference 2001, San Diego.

## **16. COMMENTS**

The provincial and district level Ministries of Education, Health and Agriculture continue to be wholly supportive of our project in Embu District and Eastern Province. They have helped with extensive use of vehicles, secondment of personnel (District Nutritionist, Community Nutritionist), use of laboratory and clinic facilities, as well as use of two building and land at the Rural Health Center at Karurumo. Also physicians, nurses, clerical officers have worked short term with the project as needed. In addition, the Department of Pediatrics, University of Nairobi,

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\* \* Joining UCLA Faculty Jan. 2001

has loaned us a vehicle (Toyota Landcruiser) for the remainder of the project, as has KARI. Without this assistance, the project would not have been implemented according to schedule.

We would also like to acknowledge the invaluable volunteer assistance given throughout the year. Ms. Meg Demment, Ms. Amanda Freschauf and Ms. Alexandria Hughes spent five weeks in the field, and were extremely helpful with eye testing, physical exams and laboratory tests. Also Ms. Susan Johnson from GLCRSP Management Team spent three weeks with the project in Embu as a volunteer, helping the Team in several very important areas. We also wish to thank the Peace Corps' Kenya Office for assisting us with data entry by allowing Mr. Jim Barth to work two days each week with the project for the past nine months.

We acknowledge Dr. Nathan Congdon of Johns Hopkins University, Dept. of Ophthalmology for the training in use of a dark adaptometer equipment test for pupillary response, to measure of vitamin A deficiency, and Mr. Eric Schwietz, a University of Kentucky Medical School student who directed the pupillary response testing in the field.

## APPENDICES

Appendix 1: *Data Entry Status Report*

Appendix 2: *Abstracts Submitted*

Appendix 3: *Relevant Newspaper Articles*

**Appendix 1: *Data Entry Status Report***

TERMINOLOGY							
For Data Collected once per term:			For Data Collected Monthly:				
R1= Round one (Baseline), June-Aug 1998			V1= Visit One (+Date of Visit)			QC= Quality Control	
R2= Round two, Sept-Nov 1998						Measures	
R3= Round three, Jan-Mar 1999							
R4= Round four, Sept-Nov 1999							
R5= Round five, May-July 2000							
DATA	Arrived	Format	E-mail/ diskette	LOCATION:	Documents Received:		
	UCLA			C:\GLCRSP\Data\	QC	Codebook	Manual
<b>PSYCH DATA</b>							
Teacher Quest R1	Sep-99	Access	Diskette	Psych\Teacher Quest	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Teacher Quest R2	Sep-99	Access	Diskette	Psych\Teacher Quest			
Teacher Quest R3	Sep-99	Access	Diskette	Psych\Teacher Quest			
Teacher Quest R4	Feb-00	Access	Diskette	Psych\Teacher Quest			
Teacher Q R4 (t3 99)	Oct-00	Access	Diskette	Psych\Teacher Quest	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Teacher Q R5	Oct-00	Access	Diskette	Psych\Teacher Quest			
Cognitive Sum. R1	Jul-99	Access	Diskette	Psych\cognitive...			
Cognitive Sum. R2	Jul-99	Access	Diskette	Psych\cognitive...			
Cognitive Sum. R3	Sep-99	Access	Diskette	Psych\cognitive...			
Cognitive Sum. R4	Feb-00	Access	Diskette	Psych\cognitive...			
Cognitive Sum. R5	Nov-00	Access	Diskette	Psych\cognitive...	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Exam Grades R1							
Exam Grades R2							
Exam Grades R3							
Exam Grades R4					<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Exam Grades R5	Oct-00	Access	Diskette	Psych\cognitive...			
End Term Results T2 2000	Oct-00	Access	Diskette				
Attendance R1	Sep-99	Access	Diskette	Psych\Attendance			
Attendance R2	Sep-99	Access	Diskette	Psych\Attendance			
Attendance R3	Sep-99	Access	Diskette	Psych\Attendance			
Attendance R4					<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Attendance Term 1 2000	Oct-00	Access	Diskette	Psych\Attendance			
Attendance R5	Nov-00	Access	Diskette	Psych\Attendance			
Adult Literacy	Feb-00	Access	Diskette	Psych\Adult lit			
Classroom Obs R1	Jul-99	Access	Diskette	Psych\Class Obs..	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Classroom Obs R2	Jul-99	Access	Diskette	Psych\Class Obs..			
Classroom Obs R3	Sep-99	Access	Diskette	Psych\Class Obs..			
Classroom Obs R4	Feb-00	Access	Diskette	Psych\Class Obs..	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Classroom Obs R5	Oct-00	Access	Diskette	Psych\Class Obs..			
Playground Obs R1	Jul-99	Access	Diskette	Psych\Play..			
Playground Obs R2	Jul-99	Access	Diskette	Psych\Play..			
Playground Obs R3	Sep-99	Access	Diskette	Psych\Play..			
Playground Obs R4	Feb-00	Access	Diskette	Psych\Play..	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Playground Obs R5	Oct-00	Access	Diskette	Psych\Play..			
Class Charact. R1	Jul-99	Access	Diskette	Psych\Class Char			
Class Charact. R2	Jul-99	Access	Diskette	Psych\Class Char			
Class Charact. R3	Feb-00	Access	Diskette	Psych\Class Char			
Class Charact. R4	Feb-00	Access	Diskette	Psych\Class Char			
Class Charact. R5	Nov-00	Access	Diskette	Psych\Class Char			
Sylogism testing R5							
<b>PHYSICAL DATA</b>							
Anthropom V1 7/98	Jul-99	Access	E-mail	Physical\Anthro..	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Anthropom V2 9/98	Jul-99	Access	E-mail	Physical\Anthro..			
Anthropom V3 10/98	Jul-99	Access	E-mail	Physical\Anthro..			
Anthropom V4 11/98	Jul-99	Access	E-mail	Physical\Anthro..			
Anthropom V5 12/98	Jul-99	Access	E-mail	Physical\Anthro..			
Anthropom V6 1/99	Oct-99	Access	Zip Disk	Physical\Anthro..			
Anthropom V7 2/99	Oct-99	Access	Zip Disk	Physical\Anthro..			
Anthropom V8 3/99	Oct-99	Access	Zip Disk	Physical\Anthro..			
Anthropom V9 4/99	Oct-99	Access	Zip Disk	Physical\Anthro..			
Anthropom V10 7/99	Feb-00	Access	Diskette	Physical\Anthro..			<input checked="" type="checkbox"/>
Anthropom V11 9/99	Feb-00	Access	Diskette	Physical\Anthro..			<input checked="" type="checkbox"/>
Anthropom V12 11/99	Mar-00	Access	Diskette	Physical\Anthro..			
Anthropom V13 01/2000	Mar-00	Access	Diskette	Physical\Anthro..			
Anthro V13 edited	Jul-00	Access	Diskette	Physical\Anthro..			
Anthropom V15	Aug-00	Access	Diskette	Physical\Anthro..			
Anthropom V16-17	Oct-00	Access	Diskette	Physical\Anthro..			

Physical Exam Baseline	Nov-98	raw forms		UCLA office			
Physical Insp V1-6	Oct-99	Access		Physical\Physical Insp			
Physical Insp V8-9	Feb-00	Access	Diskette	Physical\Physical Insp			
Physical Insp V10	Mar-00	Access	Diskette	Physical\Physical Insp			
Physical Insp V11						☒	
Physical Insp V12	Jul-00	Access	Diskette	Physical\Physical Insp			
Physical Insp V13	Oct-00	Access	Diskette	Physical\Physical Insp			
Physical Insp V14	Oct-00	Access	Diskette	Physical\Physical Insp			
Clinical Exam 11/99	Mar-00	Access	Diskette	Physical\Physical Insp			
Clinical Exam July 2000	Oct-00	Access	Diskette	Physical\Physical Insp			
Vision/Hearing	Oct-00	Access	Diskette	Physical\Physical Insp			
Health History	Nov-98	raw forms		UCLA office			
Parent Anthropometry							☒
Morbidity V1 10/98	May-99	Access	Diskette	Physical\Morbidity..	☒	☒	☒
Morbidity V2 11/98	Jul-99	Access	Diskette	Physical\Morbidity..			
Morbidity V3 1/99	Oct-99	Access	Diskette	Physical\Morbidity..			
Morbidity V4 2/99	Oct-99	Access	Diskette	Physical\Morbidity..			
Morbidity V5 3/99	Oct-99	Access	Diskette	Physical\Morbidity..			
Morbidity V6 4/99	Oct-99	Access	Diskette	Physical\Morbidity..			
Morbidity V7 6/99	Nov-99	Access	Diskette	Physical\Morbidity..			
Morbidity V8 7/99	Feb-00	Access	Diskette	Physical\Morbidity..			☒
Morbidity V9 9/99	Feb-00	Access	Diskette	Physical\Morbidity..			☒
Morbidity V9 QC	Oct-00	Access	Diskette	Physical\Morbidity..			
Morbidity V10 11/99	Mar-00	Access	Diskette	Physical\Morbidity..			
Morbidity V11 1/00	Mar-00	Access	Diskette	Physical\Morbidity..			
Morbidity V12	Jul-00	Access	Diskette	Physical\Morbidity..			
Morbidity V13	Aug-00	Access	Diskette	Physical\Morbidity..			
Morbidity V14	Oct-00	Access	Diskette	Physical\Morbidity..			
Morbidity V15	Oct-00	Access	Diskette	Physical\Morbidity..			
<b>BIOCHEMISTRY</b>							
Vitamin A	Aug-99	Excel	E-Mail	Physical\Biochemistry	Standard Protocol (UCD)		
Vitamin B12/Folate	Aug-99	Excel	E-Mail	Physical\Biochemistry			
Hemoglobin	Sep-98	Excel	Raw Data	Physical\Hemoglobin			
Hemoglobin	Nov-99	Access	E-Mail	Physical\Hemoglobin			
Composite (Hg,Fe,Cu..)	May-99	Excel	E-Mail	Physical\Biochemistry			
Stool Analysis	Jan-99	Excel	E-Mail	Physical\Blood smears			☒
Blood Smears (malaria)	Oct-98	Excel	E-Mail	Physical\Blood smears			
Malaria status 98,99,00	Oct-00	Access	Diskette				
<b>SES/Census</b>							
Census	Apr-99	Access	E-mail	Census-SES\SES	☐	☒	☒
Census mod. 7/00	Jul-00	Access	disk	Census-SES\SES	☐	☒	☒
Census mod. 8/00	Oct-00	Access	disk	Census-SES\SES	☐	☒	☐
SES	May-99	Access	E-mail	Census-SES\Census			
SES V1	Oct-00	Access	Diskette	Census-SES\Census			
<b>FOOD INTAKE</b>							
Food Codes	Dec-99	Access	Zip Disk	Food\Food-Quantity codes			
Food Intake V1 6-8/98	Nov-99	Access	Diskette	Food\Food intake...	☐	☒	☐
Food Intake V2 7-9/98	Nov-99	Access	Diskette	Food\Food intake...			
Food Intake V3 7-9/98	Nov-99	Access	Diskette	Food\Food intake...			
Food Intake V4 12/98	Dec-99	Access	Zip Disk	Food\Food intake...			
Food Intake V5	Jan-00	Access	Diskette	Food\Food intake...			
Food Intake V6	Jan-00	Access	Diskette	Food\Food intake...			
Food Intake V7	Jan-00	Access	Diskette	Food\Food intake...			
Food Intake V8	Feb-00	Access	Diskette	Food\Food intake...			
Food Intake V9	Feb-00	Access	Diskette	Food\Food intake...			
Food Intake V10	Feb-00	Access	Diskette	Food\Food intake...			
Food Intake V11	Feb-00	Access	Diskette	Food\Food intake...			
Food Intake V12	Jul-00	Access	Diskette	Food\Food intake...			
Food Intake V13	Feb-00	Access	E-mail	Food\Food intake...			
Food Intake V14	May-00	Access	E-mail	Food\Food intake...			
Food Intake V15	Feb-00	Access	E-mail	Food\Food intake...			
Food Intake V16	Mar-00	Access	diskette	Food\Food intake...			
Food Intake V17	Jul-00	Access	diskette	Food\Food intake...			
Off-cohort feeding	Dec-99	Excel	Zip disk	Food\Feeding Records			
Feeding Records R2	Dec-99	Access	Zip Disk	Food\Feeding Records	☐	☒	☒
Feeding Records R3	Feb-00	Access	Diskette	Food\Feeding Records			
Feeding Records R4	Dec-99	Access	Zip Disk	Food\Feeding Records			
Feeding Records T3 99	Aug-00	Access	diskette	Food\Feeding Records			
Feeding Records T1 00	Aug-00	Access	diskette	Food\Feeding Records			
Feeding records T2 00	Oct-00	Access	diskette	Food\Feeding Records			

## **Appendix 2: *Abstracts Submitted***

**Presented by Jonathan Siekmann at Experimental Biology 2000 Annual meeting (Society for International Nutrition Research). San Diego, April 2000**

Intervention with animal products in Kenyan schoolers: impact on micronutrient status and interactions with malaria.

In recent years it has been recognized that inadequate quantity and quality of dietary micronutrients is the underlying cause of many nutrition problems in developing countries, including anemia, poor growth, and poor motor and mental function. To a large extent this is due to a low intake of animal products, which contain high amounts of available micronutrients. Animal product intake has been associated with micronutrient status and function in a number of studies, but there have been no direct intervention studies of the effect of meat on children's development, and few studies of the benefits of milk, none of which were controlled.

The purpose of this research is to evaluate the effect of supplementing children with animal products on micronutrient status and malaria infection. Subjects were 530 Kenyan schoolers age 6-9 y in 12 schools. The schools were randomly assigned to provide either milk, meat, or vegetable oil added in equicaloric amounts to a vegetable stew, and provided daily to the children under supervision over a 12-mo period. A control group received nothing until the end of the study. Baseline blood samples indicated a high prevalence of anemia (60% with Hb <120 g/L), and deficiencies in vitamin A (>90%), vitamin B-12 (30%) and zinc (50%). The high prevalence of anemia is in part caused by malaria (malaria parasites were present in 7% of the children), and 20% had infection as indicated by elevated C-reactive protein. The iron status of the children is difficult to interpret because ferritin concentrations were high on average (mean=80 mg/mL), with over 90% in the normal range, yet 30% of children had low serum iron. Iron status is also being assessed with transferrin receptors which are less susceptible to the influence of infection than is serum ferritin, and will be compared by malaria status independently of CRP concentrations.

At baseline, some measures of micronutrient status (hemoglobin, ferritin, and zinc) were significantly different, depending on whether the child was currently infected with malaria, and the impact of current malaria infection on micronutrient status indicators are being examined in the post-intervention samples. Furthermore, the association between baseline micronutrient status and subsequent number of malaria episodes during the next 12 months will be evaluated in the control group. Post-intervention samples are currently being analyzed to evaluate the effect of the interventions on micronutrient status, number of malaria episodes, and the impact of malaria incidence during the year on response to intervention. (Supported in part by the Global Livestock CRSP, USAID).

**Submitted by S. Whaley and T. Cohen for the SCRD 2001 conference, San Diego.**

### **IQ on the Rise? The Flynn Effect in Rural Kenyan Children**

Multiple studies have documented significant IQ gains over time, labeled the “Flynn Effect” by Charles Murray due to James Flynn’s inference that IQ gains are part of a persistent and perhaps universal phenomenon. Data now available from 20 nations show massive IQ gains over time, most notably in culturally reduced tests like the Raven’s Progressive Matrices that are purported to be the purest measures of intelligence (Flynn, 1987, 1999). The nations included in analyses are the most advanced nations of continental Europe and North America. Similar IQ gains have also been documented in Australia, New Zealand, Israel, Japan and urban Brazil and China. To our knowledge, this is the first study to document the Flynn Effect in a rural area of a developing country.

Data for this study were collected during two large studies in Embu, Kenya. The Nutrition Collaborative Research Support Program (CRSP) was an observational study undertaken in 1984, designed to explore the relationship between diet and cognitive development in a mild to moderately malnourished population of women, infants and children. In May-July, 1984, 129 6-9 year old school children were tested using the Raven’s Progressive Matrices, the Digit Span subtest of the WISC, and a Verbal Meaning test similar to the PPVT, but modified for use in rural Kenya. In 1998, a second Collaborative Research Support Program was funded in Embu, designed to test the impact of a school feeding program on Kenyan school children. In May-July, 1998, prior to starting the feeding intervention, 537 6-9 year old school children were tested using identical cognitive measures. In both studies, local women carried out all testing in the local language (Kisumu), and three of the six testers worked on both studies.

Results from these studies show a significant increase in cognitive scores over the 14 year period on all three tests (see Table 1). As noted in the studies by Flynn, the most significant increase is shown on the Raven’s Progressive Matrices. Smaller, significant gains in verbal abilities and digit span are also evident. Researchers have posited multiple environmental explanations for the rise in IQ in developed nations, including improved nutrition, greater test sophistication, enhanced socioeconomic status (SES), the proliferation of computer and video game technology, and a general increase in the sheer complexity of the modern world. The potential relevance of each of these environmental factors will be presented in this study. Environmental factors that fall short of explaining significant IQ gains in developed countries and urban areas may more adequately account for the significant IQ gains in rural areas of developing countries. Specifically, increases in SES, improved nutritional status, rising parent literacy rates, and increased importance placed on preschool and early education for children will be suggested as likely contributors to the significant increase in all indicators of intellectual functioning in this population. The magnitude of the gains, importance of using raw scores for comparisons, and implications of significant gains across the three cognitive measures will also be addressed.

Table 1:  
Raven's Progressive Matrices, Verbal Meaning, and Digit Span Raw Scores of Rural Kenyan School Children: 1984 and 1998.

	n	Age in Years	Raven's	Verbal Meaning	Digit Span
1984 Cohort	129	7.41 (.46)	12.53 (3.20)	23.79 (6.52)	4.44 (2.29)
1998 Cohort	537	7.36 (.54)	17.31 (2.56)***	27.04 (4.85)***	5.03 (1.82)**

\*\*\*p<.001

\*\*p<.01

#### References

Flynn, J. (1987). Massive IQ gains in 14 nations: What IQ tests really measure. Psychological Bulletin, 101, 171-191.

Flynn, J. (1999). Searching for justice: The discovery of IQ gains over time. American Psychologist, 54, 5-20.

### **Appendix 3: *Relevant Newspaper Articles***

***Kenya Daily Nation December 8, 1999***

**News**

Wednesday, December 8, 1999

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Hunger forces out 2,895 pupils

By NATION Correspondent

A total of 2,895 pupils dropped out of school this year alone in Mwingi District due famine.

The District Education Officer, Mr Silvester Shiundu, also told a district development committee meeting, attended by Education Minister Kalonzo Musyoka that a primary school headmaster was shot with an arrow by the school watchmen when he was allegedly found stealing beans meant for the school feeding programme.

Mr Shiundu caused laughter when he said that the watchman had been instructed by the school committee, chaired by the headmaster, to shoot on sight anybody found stealing food.

Mr Musyoka said the district has a deficit of 600 primary school teachers. He said there were 2,585 teachers instead of 3,122.

Mr Musyoka said that big towns in the country were overstaffed while rural areas were lacked enough teachers. The Minister attributed this to husbands working in towns effecting the asking for transfers for their spouses from rural areas to towns.

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## ***Kenya Daily Nation November, 1999***

### **News**

Wednesday, November 3, 1999

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Experts predict continued drought

By NATION Correspondent

Most parts of the country will continue experiencing reduced rainfall in November, prolonging the current drought for an indefinite period.

The Meteorological Department predicted that the country would experience less than 50 per cent of the expected rainfall in November. It added that the Western highlands, Lake Victoria region and parts of central Rift Valley had a high possibility of receiving high rainfall. However, North Eastern Province, Coast region and parts of the central districts may experience low rainfall.

Meteorological Department director Evans Nyakwanda said this when he addressed the Press at the headquarters. He attributed reduced rainfall to the state of the sea surface temperature. Mr Nyakwanda said his department would continue working closely with the Ministry of Agriculture to inform farmers on the best times to start planting.

He, however, said the 35 weather stations should be increased to 70 and the 2,000 rain gauges to 10,000 if the department was to adequately provide information in a more accurate and faster manner. The director explained that the continued drought will affect availability of water for domestic and industrial consumption.

Power rationing is to continue as there will be less water available for hydroelectric power generation. The persistent water deficit and high temperatures will also lead to inadequate water supply in bore holes, springs and wells. The department has advised farmers in the eastern part of the country to plant drought-resistant and short maturing crops. Farmers in the west have been told to plant more food to assist other regions as they will be less affected by famine. The department said wild animals were likely to stray into inhabited areas due to hunger.

The department also advised that care should be undertaken when handling fires as dry conditions were likely to provide potential for fires that could clear out forests. People living next to wildlife have been warned to be on the lookout as wild animals are likely to live their secluded homes into their farms in search of water and pasture.

The government was advised to find ways of storing water during the rainy seasons and also introduce alternative power supplies like wind or solar so as not to be affected by unavailability of electricity.

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## ***Kenya Daily Nation, April 30, 2000***

### **Special Report**

Sunday, April 30, 2000

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## Famine alert in Horn of Africa

By WAMUYU GATHERU

Institutions with famine early warning systems predict drought and food shortage in the Horn of Africa. Countries expected to experience serious drought include Ethiopia, Kenya and Somalia.

The government of Ethiopia has already issued an urgent request for food for eight million people under severe threat of hunger. The World Food Programme has appealed to the international community to help. In Kenya, the silence that usually precedes famine is rather ominous. Cattle grazing in Nairobi's suburbs are an indication that pastoralists are under pressure. Recently, the Permanent Secretary in the Ministry of Agriculture and Rural Development was quoted in the press calling for partial lifting of duty for maize to facilitate imports. It appears that yet again political sensitivities associated with famine alert may compromise response for Kenyans under threat of starvation.

Maize imports from Tanzania and Uganda have reduced the deficit of the last season. However, high production costs last year raised consumer prices above the estimated long term average. Maize imports will lower consumer prices and increase stocks for vulnerable communities. The producers obviously do not favour importation through duty waivers. However, with the expected drought, consumers, particularly in eastern Kenya, who will not receive adequate long rains should be given priority in decision-making. If the decision is made too late, thousands of lives could be compromised.

While maize serves as a standard measure of national food reserves, pastoral indicators such as the grazing of cattle in the city, are also critical. These indicators include the price of livestock, with low prices during drought, increased insecurity and irregular migration. The recent conflicts in Wajir, Moyale and Garissa which required the intervention of the security forces are an indication of battles for limited pasture and water. Tension is presently high in Naivasha where pastoralists are seeking pasture on private farms.

This is what the food, pasture and water situation is like; the annual consumption of maize is approximately 2.8 million tonnes. Presently, 2.21 million tonnes have been harvested. It is estimated that the private sector can meet the 210,000 tonnes deficit. However, to aid imports, the government must first suspend import duties.

Although there is a general agreement that duty needs to be suspended, no decision has been made. Information available indicates that any further delays on imports could jeopardise disaster management efforts. It is hoped that well-connected parties are not delaying the decision to serve their business interests.

If it does not rain soon, the food situation could remain precarious for most of the year. The Ministry of Agriculture says that so far, less than 30 per cent of expected planting has been accomplished. Central, Eastern and Coast provinces are particularly dependant on the long rains for crop production. In these areas, less than 20 per cent of planting has been done. Of national concern is the effect of delayed long rains on the Rift Valley Province, often referred to as the country's "grain basket".

The impact of several dry seasons has increased the deterioration in pasture and water. The worst-hit areas include Turkana, Marsabit, Moyale and Samburu districts as well as western Mandera and northwestern Wajir District. Water distances have increased to an unusual 40-60kms in these areas. It is reported that pastoralists and monkeys are competing for tanker water in Mandera District.

A quick check on Kenya's disaster management capacity provides little encouragement. Droughts are our most predictable events but the country is ill prepared to manage them. Ideal disaster management should

facilitate minimal time between knowledge of a possible crisis and subsequent response. The less the reaction time, the more the lives that are saved and, the cheaper the cost.

Kenya has no disaster policy. Even if one accepts the argument of limited government resources, there is still the failure of government to play a facilitative role for other organisations. The problem with Kenya's drought management systems starts, quite naturally, at the top. An institution is needed to give the go ahead to a series of government ministries and departments to move to action. The institution in this case would be the National Disaster Management Executive Committee in the Office of the President. The main functions of this committee is to formulate disaster management policies, provide direction to plans for disaster preparedness and define responsibilities for the various disaster management agencies. This committee, supervised by the Cabinet and chaired by a Cabinet Minister, has met infrequently and made no progress on its mandate. We are thus unlikely to obtain decisive action from the committee.

The committee has a coordination team in charge of routine disaster response. Its members are drawn from various ministries and departments under the chairmanship of the Permanent Secretary. However, although the co-ordination committee has an Operations Centre, the committee is usually only convened in the event of a disaster. Convening in this ad hoc manner is a permanent drawback to response.

Personnel experience is of a non-emergency nature as staff are drawn from regular positions. The Operations Centre, established during the El Nino emergency of 1997 is open 24 hours but lacks any legal basis to act with speed in the event of emergencies. Its powers are informal and it relies upon persuasion and individual initiative rather than formalised procedures legitimised by the law. There are a handful of government officials who may act in the event of a drought. These include the National Food Security Committee that is expected to advise on market interventions such as duty waivers. The provincial administration also organises efforts in disaster situations but depends on the central government's direction in policy, procedure and supplies.

Ironically, but not surprising, local authorities are rarely party to drought response. Local authorities, by virtue of being administratively decentralised, could be effective institutions in both predicting and managing disasters. However the powers of local authorities have been usurped by the Ministry of Local Authorities and the provincial administration. The Police and the Department of Defence may also be invited to assist. All these actors have limitations as well as unique capacities which could be harnessed in a concerted effort to reduce the effects of famine. For example, the armed forces have trained personnel of a wide range including engineers who could restore boreholes and doctors who could run medical units. The Army has a good knowledge and wide coverage of Kenya's geographical space and its personnel are trained to work in harsh environments.

There also exists a large number of NGOs, religious groups and UN agencies that have independent operations for managing drought. These groups generally conduct their activities independently. Without a national disaster policy, each organisation uses systems and procedures that they are familiar with and have some degree of control over.

A few months ago, when the press alerted the Kenyan public to respond to hunger in Turkana, this writer witnessed significant inefficiency among non governmental actors. Although these agencies have officers in the remote parts of northern Kenya, communication is a major handicap. One organisation had to wait several days to obtain information on the supplies required by communities in Turkana. When the information arrived, the appropriate vehicle to make the long distance trip on rough road was not available. At one meeting, lengthy discussions were held on how to organise staff donations. It appeared that although

seeking foreign donations could yield more resources faster, this was not pursued. Ideally, all agency contributions should go to the organisation that has the widest, fastest and most efficient distribution. Lack of a legitimate coordination agency and mutual operational distrust makes this one-track approach impossible.

Government disaster agencies are often frustrated by some NGOs, especially in distributing relief food. They consider the NGOs disorganised and unprofessional by emergency response standards. Some organizations have over supplied food or targeted supplies inappropriately resulting in migration and aid dependency by some communities. Information sharing with NGOs with grassroots presence is usually done through the District Development Committees (DDCs). However there are no formal information reporting formats and information links from the DDCs to the communities are weak.

The UN efforts are often well co-ordinated but depend on diplomacy in organizing operations. If the government says there is no drought the UN cannot insist that drought exists and certainly cannot call it by its name. The UN systems operate independently and only act in co-operation for information purposes only. The UN also has enough red tape of its own and is generally considered an expensive agency for any relief and development exercise.

Kenya needs to create a disaster policy that addresses legal, institutional and operational aspects. Special powers need to be provided in the law for the Cabinet to act on in the event of an emergency. The Executive committee mentioned earlier should be discontinued and the Coordination Committee expanded to include players of competent actors from the NGOs, private sector and UN. The Coordination Committee should have the necessary powers to call various agencies especially within government to action. A national system for disaster management should be established that includes the full cycle of disasters - prevention, mitigation, preparedness and response.

These discussions for improved disaster management are not new to both government and non-governmental agencies involved in disaster management. Kenya still has no disaster policy and the buck for too little too late responses stops with the government. Unfortunately the poorer Kenya's economic performance the more prone the country is not just to famine but to other innumerable disasters. However there is little excuse for lack of organization at the national level. Disaster responses around the world indicate that there continues to exist an international community willing to donate to emergencies. Drought need not be a disaster. But even donors cannot operate in vacuums and their efforts are only as good as supporting national institutions.

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***Kenya Daily Nation, September 1, 2000***

**Editorial**

Friday, September 1, 2000

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Drought: Why did we ignore the Met?

It is intriguing to learn that the Government – specifically the President's Office and the Ministry of Agriculture – had been forewarned that drought was impending but that they did nothing about it.

While it would be absurd to blame the Government for natural phenomena, this much we must say. The most sensible course would have been to take seriously the early warnings by the Meteorological Department and the Nairobi-based Drought Monitoring Centre, and take measures to ensure adequate food was stored for such contingencies.

According to Met Director Joseph Mukabana, the reason predictions of such nature are not taken seriously – even though the Government is furnished with such details every day, week and month – is that no disaster management system is in place to mobilise resources to counter the effects of unseasonable weather.

This is unfortunate. An inter-ministerial body of officials charged with monitoring changing weather patterns and seeking answers to problems relating to future food needs, the effect of weather on infrastructure, and the logistics of distributing disaster relief is urgently called for.

At the moment, at least three million Kenyans are threatened by starvation and millions of others with acute food shortages. However, despite several appeals for relief food, the response has not been very encouraging. If we had heeded the weathermen's warnings, we would not be in this pass. At least we would have started looking for relief food earlier.

It is true that, given the same warning, none of the other Eastern African countries did anything either. But that is cold comfort.

Our economy has slowed down to a meagre 0.25 per cent, a drop from the predicted 2.6 per cent. As Finance Minister Chris Okemo has admitted, no budgetary provisions were made for the prolonged drought, and now the Government is being forced to have another look at the figures.

There is an obvious lesson for us here. It is not for lack of information that we are caught unawares by natural calamities. As some wag once put it, two-year droughts don't just happen. Let us hope the bureaucrats start showing more confidence in the weathermen's predictions and acting appropriately.

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