



ANNUAL REPORT: 1998-1999

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

This past year saw the successful implementation of the controlled school feeding intervention study in twelve rural Kenyan schools comprising ~525 first and second grade children. This included the careful and quantitative preparation of three different types of feedings, daily delivery of the feedings to the children during the three school terms of the year, the collection of all ongoing measurements, a one-year follow-up collection of blood samples for micronutrient analyses, and the successful collection of baseline data on a second cohort of children.

Data management procedures were established, and the Embu office now has a well-functioning data unit that is processing the approximately 47,000 data forms collected during the year with data transmission to UCLA, and analyses have begun.

Some notable problems that emerged included sporadic school attendance due to parents not able to pay school fees, and a drought that has been escalating for the past several months and that may have differential effects on the regions in the study area. We have been closely monitoring the household food situation and keeping the local government informed. So far relief intervention in the area has not occurred and the rains returned in late November 1999, with a harvest hopefully in January.

Field Operations:

This year began with the new Field Director, Dr. Edith Mukudi, firmly in place, and also saw the recruitment of additional staff in Kenya, including George Rabar, a computer programmer and consultant; Lillian Njue, a pediatric nurse; and four additional data entry staff. Total staff in Kenya now number 130 Kenyans and one German national. Staff training has been ongoing throughout the year.

The addition of a second cohort of ~500 Standard I children, and the collection of baseline data beginning in May was made possible by a National Cattlemen's Association grant. The food preparation building and shed were expanded in order to accommodate this second cohort. Also, a reliable Toyota Landcruiser has been loaned to the project by the Pediatrics Department of the University of Nairobi, relieving the transportation shortage.

Data Management:

Accomplishments this year include the establishment of a streamlined data management system. Quality control procedures have been adhered to and staff retraining is ongoing to maintain high quality of the data collected. Careful error correction of data starts in the field by the supervisory enumerators and then by each function director, and overall quality and final checking is done by Dr. Edith Mukudi prior to data entry.

The Embu Data Entry Unit is headed by M. Grillenberger, who is responsible for all data entry aspects, range checking, data checking and correction, and transmission of data to the United States. Data entry is now current except for a backlog in food intake, which is now progressing well.

Analyses of baseline data have been completed and reveal that a third of the children are moderately malnourished, there is a high prevalence of anemia and endemic malaria as well as widespread micronutrient deficiencies. Analyses of the data collected during this first year of feeding are currently underway.

Leveraged Funding:

We obtained funding from the National Cattlemen's Beef Association for \$150,000 for two years to add a second cohort to the study. Also, six of the eight trips made to the project site by US team members were paid for by outside sources, including UCLA's International Studies Program, and UCLA's African Studies Center. We were, however, unsuccessful in obtaining leveraged funding from in-country sources such as UNICEF or USAID.

4. RESEARCH

A. Problem Statement and Approach

The original problem statement defined the problem of poor diet quality and low micronutrient content of the diet among the rural Embu people. The proximate causes identified were the lack of animal source foods in the diet and low fat intake: poverty, lack of knowledge of child feeding and poor household food security. Baseline biochemical analyses of the study children have confirmed poor micronutrient nutritional status. Poor availability and household access to animal source foods and low utilization were the barriers identified.

The problem analyses and statement suggested a two-phase sequence. Phase I consists of a controlled feeding intervention study of school children to test if animal source foods, particularly meat, eaten at school each day by Standard I children (ages 6 to 9 years) improves their micronutrient status, cognitive function and school performance, attention, and physical activity, physical growth and health compared to these parameters in children who receive either added milk or extra calories (oil), or no feeding intervention. All feeding groups receive the local dish *githeri*, a mixture of maize, beans and greens. A comparison group receives no school feeding and serves as a control group. This latter group will receive compensation in kind after the research phase is completed. Thus between-child and within-child comparisons will be possible.

This controlled intervention study, the sole research activity, 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 now in the study. The feeding intervention group assignment is the same as for Cohort I, the original cohort. Thus the same type of feeding is delivered to the four study classrooms in each school and the control schools, as before, receive no intervention feedings. Feeding the second cohort started in September 1999 and is planned for an entire year which contains three school terms. Inclusion of cohort II is being supported by a National Cattlemen's Beef Association Grant, which does help subsidize the feeding and study of the original GLCRSP-supported Cohort I of 550 children. The school feeding staff (one per classroom per school) has been doubled and additional cooking, food preparation and cleaning staff have been hired. The food preparation area has been doubled in cooking space (the shed) and storage capacity.

To make the data collection and entry manageable, as of September 1999, data collection for most types of measurements have been cut back to every other month (anthropometry, morbidity, 24-hour recall, intake at home); and cognitive, activity, and behavioral measures are now being done every other term. In reviewing the data from Cohort I with the statistician and the principal investigators, it was observed that all the variables changed little from month to month and from term to term, and fewer data points per year would suffice. The only added data entry is the baseline for Cohort II and monthly food intake during the previous school term. Because of the severe drought of August-December 1999, food intake has been measured monthly through December 1999 to better monitor the food situation.

The doubling of the sample is desirable for several reasons.

1. Many repeaters can now be fed together with their own classrooms and classmates, and won't 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.
4. It would be desirable to have a cohort not subject to drought conditions.

In Phase II, years 2000-2003, we plan to initiate community-household and school-based interventions, working with livestock NGO's in two or more East African countries. The approach would be to increase availability of a variety of small animals (rabbits, chickens, goats, etc.) to households in order to enhance the ability of families to increase the amount of meat in their diet and also to derive some income generation activities from the sale of some of the animals and their products. The main targets would be the family, but pre-school and school children and women of reproductive age-- the most vulnerable groups-- would especially be targeted. The NGO's would be helpful in the organization of groups of women into small credit groups to obtain the animals and to train the women in the care, feeding, management, and breeding of these animals. Our team's responsibility would be to increase the utilization of these animals for diet improvement by intensive, practical, hands-on participatory nutrition education on how to slaughter, process, preserve, prepare and cook the meat for consumption by the family. The NGO's would be instrumental in training community volunteers as "paravets" or community health workers for animal care and to help with the marketing of any extra meat produced after satisfying household nutritional need. We plan to collaborate with several livestock oriented NGO's such as Heifer Project International or Farm Africa as a start and would develop close ties with such groups as KARI, ILRI, and the schools, 4H clubs and women's groups. Intervention sites would be in Kenya and Uganda and possibly a third site. The primary schools could serve as a focal point for many of the activities. Thus, we hope to initiate a parent, child, school partnership to institutionalize school feeding and improve the quality of the feeding at the household level.

A small, related project has been in progress since 1998 in collaboration with the Child Health and Development Center (CHDC) of Makerere University. Our team was funded by the Thrasher Research Fund for a small two-year community intervention project in rural Uganda to increase consumption of animal source foods by rural subsistence families. We are working with an NGO called VEDCO that supplies the expertise in community organization, rabbit care, rearing, breeding, and marketing. Their focus has been on marketing of rabbit meat and income generation. The input of our team is to work in the communities with women's groups who are raising the rabbits and increase household consumption of rabbit meat through intensive, hands on participatory nutrition education. The women would develop recipes and try these out. The CHDC has highly trained community nutrition educators. The team monitors food intake and child nutrition status - mainly growth and anemia. We consider this a "non-official GLCRSP" related project which would be formally linked in the future.

In summary, the project currently involves the implementation of the controlled feeding intervention study of school children in Embu, Kenya. A second cohort of ~500 Standard I schoolchildren was added to the study in September 1999 following the procedures in place for Cohort I. Data analyses in all study components is now underway with a steady flow of clean, high quality data from the field.

B. Progress

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

Criteria for Evaluation of This Project as Stated in the 1998-1999 Work Plan

1. Execution of research objectives
2. Timely analysis of findings
3. Degree of dissemination of findings
4. Leveraging of funds
5. Policy analysis, formulation, dissemination by policy-steering group
6. Successful implementation of school feeding in 9 schools for the Sept.-Term and continuation for another two school terms when children become Standard II students; continued inclusion of the three control schools for data collection and observation but no feeding intervention cooperation.
7. Successful inclusion of Standard I repeaters in the research program.
8. Carrying out of scheduled measurements, preliminary analyses, and report of preliminary descriptive findings.

1. Execution of Research Objectives

The research objectives are on target. The initial cohort of ~525 Standard I children have been continuously under study and have been receiving intervention feedings. The children just completed their fourth term of feeding and have now been in the study for 1 year 3 months. The plan is to continue feeding them in the study for at least two more terms, and longer, if funding is forthcoming. The preparation of the three different types of feedings with careful and quantitative preparation, and daily delivery of the feedings have been executed successfully and smoothly. Leftovers have been faithfully recorded on a daily basis.

The past year's accomplishments included implementing an ongoing and complex labor-intensive field operation in Embu District; the establishment of a data management system; ongoing staff training and standardization; quality control procedures for study measurements; and analyses of baseline studies of the study sample including biochemical micronutrients.

The above activities have gone smoothly, with the exception of several notable problems including an earlier shortage of adequate transportation and a brief national teachers' strike in October 1998. The teachers were promised increased pay three years ago, which has not been forthcoming. Lastly there has been a drought and food shortage in the past several months due to drastically reduced rainfall. We have been monitoring the household food situation of the study households. Another problem has been several uncooperative teachers, merging of classrooms without notice to the study team. Most serious has been the exclusion of children from school because of non-payment of fees or *harambee* (self-help) contributions to the school fund. This has been reduced through meetings with head teachers.

Some of the control group school households and classroom teachers have become less cooperative with the study, stating that since we are not feeding their children at school then why should they bother answering questions. Visits by the Kenyan Co-PI and senior staff to these households and schools seem to have gained back the cooperation of most of the above households.

Staffing: A Kenyan Field Coordinator was hired and started in Embu in September 1998. A programmer and computer expert and data entry assistants were also hired this year. The office and field staff have become an efficient and well functioning team with leadership provided locally by Prof. Nimrod Bwibo who spends 20% of the time in Embu and is always available by telephone and for meetings and by the full-time field coordinator, Dr. E. Mukudi.

Transportation: Through the efforts of Dr. Bwibo an additional Toyota Landcruiser has been loaned to the project by the Dept. of Pediatrics, University of Nairobi for the cost of repairs, licensing and insurance, so for about \$3,000 we now have reliable and adequate transportation. The KARI Subaru wagon is used as a back up, "short hop" vehicle.

Field Activities: The definitive sample of twelve schools and about 525 Standard I students (Cohort I) and their households were enrolled and fed and followed for three terms and the start of the fourth term by September 30. An additional cohort of ~500 Standard I (Cohort II) students

was enrolled, and baseline information was collected May-September 1999. In addition to the ongoing data collection, the following activities were carried out:

- The food preparation and cooking building was expanded in order to accommodate food preparations for the second cohort of children. (Please see section 4).
- The intervention foods have been checked periodically for macronutrient and micronutrient content. Aliquots from each type of feeding were tested for carbohydrate, fat, protein, and moisture in the Department of Food Sciences, University of Nairobi and for micronutrients at Medallion Labs, Minneapolis, USA.
- Baseline studies for the new Cohort II included anthropometric status, food intake, cognitive performance, physical activity, classroom behavior, teacher ratings of children, literacy testing, and a socio-economic survey and census of each household, and a monthly illness (morbidity) survey. Baseline health measurements included physical examinations and health histories, stool examinations for ova and parasites, hemoglobin, smears for red cell morphology and malaria.
- Repeat biochemical micronutrient status and hemoglobin and malaria smears were carried out on Cohort I, the original Cohort in 1998 after one year of intervention feeding. Hemoglobin and smears for malaria were repeated in July and August 1999. See Appendix I for section on hemoglobin. Also because of the drought (three missed rains) there has been less malaria reported clinically or found on thick blood smear examinations.
- Deworming for helminths was carried out in the 12 study schools on two occasions. A single dose of Mebendazole was used each time. Children with Giardia and Amoebiasis were referred to the Health Center for treatment, as Mebendazole is not effective. 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 severe anemia ≤ 7 gm/dl 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, following stool examination for parasites.

Data Entry, Transmission and Archiving

The project's data entry unit started off on a small scale with two people in September 1998, and has gradually increased to a well functioning, sophisticated, high quality unit. It is housed in the Embu Office, and the data entry unit has been headed by Monika Grillenberger since March 1999. Ms. Grillenberger is responsible for all data entry aspects, checking of printouts of entered data, against forms, error correction, range checking of data for each form and then transmission of data to UCLA as well as archiving of data in Kenya. Ms. Grillenberger also helped design the teleforms for scoring and helped compile codebooks and quality control measures.

A computer programmer and hardware specialist, Mr. George Rabar, has been assisting in the setting up of range checking and writing programs for data management. Data is then transmitted over e-mail or placed on a zip-disk and sent by courier to the U.S.A. Mr. Rabar has been

invaluable in keeping the computers, scanner and printer in good working order, doing preventive maintenance and writing programs as needed.

The data entry unit staff is now comprised of an assistant data manager (BS in Statistics and Computer Science), a senior data entry assistant with a diploma in computers and data management, four data entry assistants with diplomas in computers, and two part time data entry assistants with word-processing certificates. A Peace Corps volunteer will work two days per week starting in January 2000.

The unit contains a data scanner, three tabletop computers and a printer, all in full use for data entry. An additional computer will be added soon as well. The scanner has proven most useful for numeric data such as food intake and recipes, anthropometry, socioeconomic data, and morbidity. Although checking scanned output against the original field forms takes somewhat longer than those of the manual entry method, a good deal of time is saved by scanning in the forms for data entry. Access and/or Excel programs are used for the data entry programs.

The backlog for data entry is now caught up with the exception of food intake. Food intake is moving along well for the monthly food intake measurements, and should be caught up in the next two months. As for the quality of the data, Dr. E. Mukudi, the field coordinator, has taken responsibility for the pre-entry quality of the data. Data is being steadily transmitted to UCLA in clean, edited form and archived both in Kenya and at UCLA.

Please see Appendix IV for synopsis of data entry as of September 30, 1999.

2. Timely Analyses of Findings

For the first half of this year, the rate of data entry was a limiting factor. However, since March 1999, data entry is up to date, except for a backlog in the food intake data, which is now decreasing as the entry team is now at full force. Descriptive findings of Baseline data are found in Appendix I and briefly described below. A second round of examinations for health status and sample collection for hemoglobin, blood smears for malaria, stool exams for parasites and blood samples for micronutrient levels and C-reactive protein were collected in August and September 1999, after one year of intervention feeding. Specimens for micronutrient analyses are frozen and awaiting analyses in the next few months. This will be carried out at University of California, Davis. Urine iodine analyses were carried out for the baseline at the Medical School University of Nairobi. The laboratory is designated as a WHO recognized laboratory for Urine Iodine Analyses.

Baseline: July and August 1998

The baseline analyses are descriptive and presented for the study sample as a whole. Analyses include:

- Socioeconomic Status: Each household has been given a SES score which is based on land owned, type of housing, possessions and types of animals owned, level of education, type of

salaried employment, if any, salary, leadership position on the community, use of banks, post offices, etc.

- **Health Status:** This is based on health history and physical examination.
- **Biochemical Micronutrient Status:** Urine iodine levels were measured. Blood samples were analyzed for iron, copper, zinc, ferritin, vitamin B₁₂ and riboflavin and vitamin A, C-reactive protein was measured as an indicator of infection.
- **Hemoglobin:** This is measured to evaluate anemia using the Hemocue.
- **Malaria and stool parasites:** Thick blood smears for examination for malaria parasites, and stool specimens were examined for intestinal parasites using semi-quantitative and quantitative techniques.
- **Ongoing Analyses:** Changes over time are presented for anthropometry and morbidity and hemoglobin.
- **Cognitive Tests:** Limited and very preliminary analyses have been carried out on several cognitive subtests and physical activity during schoolyard free play.

A summary of baseline data is found in Appendix I, “Preliminary Descriptive Findings”.

3. Degree of Dissemination of Findings

The baseline data results for anemia, anthropometry, malaria and biochemical evidence of micronutrient deficiencies have been disseminated at several workshops (ILRI and HPI) and informally to the Applied Nutrition Program, University of Nairobi; USAID, Kenya; UNICEF; and the Nutrition Division, Kenyan Ministry of Health. The Ministry of Education has been informed of the findings in more lay terms. Parents whose children were found to have severe anemia ≤ 7 gm/dl, have malaria parasites, or stool parasites were informed and a referral given to the local Rural Health Center. Those with vision and hearing problems were also referred for evaluation and treatment. Parents were informed of any abnormal findings on physical exams requiring further referral and treatment. Findings to date on the 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 seminar was given by Dr. Neumann at the Applied Nutrition Program of the University of Nairobi (Kabete Agricultural Campus), and Dr. Neumann serves as an External Examiner to that program.

4. Policy Analysis, Formulation, Dissemination

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.

The multidisciplinary Policy Steering Committee Meeting was postponed until this coming April 2000. Reasons for this were the desire to have some data and findings for the groups to respond to; and a conflict with regional meetings participants had to attend this past Fall. However, the participant list has 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.

5. Leveraging Of Funds

A great deal of time and effort were spent on submission of proposals and meeting with many agencies and foundations both in Kenya and U.S.A. The two biggest disappointments were not to be able to interest anyone in REDSO, or the Kenya USAID Office in Health or Agriculture and Food Security in supporting any of our project activities. Most disappointing was to have the UNICEF Kenya Country Office of Children Health give verbal approval of a proposal then not fund it, stating a change in priorities! Another frustration was the Child Survival Office of USAID Washington. On very short notice a proposal was put together, then quickly rewritten when new guidelines became available. Despite assurances and encouragement that funding would be forthcoming with year-end monies (October 1999), nothing has been forthcoming and with no feedback whatsoever.

The whole process of seeking leveraged funding has been most time consuming and disheartening to say the least. Also, leveraged funding brings with it additional work, and it is not a sure method to increase available funding for GLCRSP project activities. Our only successful experience this year was with the National Cattlemen's Beef Association of USA, who funded us \$150,000 for two years to enroll a new cohort of ~500 Standard I children in addition to the original cohort I which is still under study and is described above. Some of these funds subsidize other project activities.

Modest funds have been leveraged from UCLA: James A. Coleman African Study Center; and the International Studies and Overseas Program Office. They have given Dr. Neumann several travel grants of about \$2000-\$3000 to visit the field site and supported planning of the upcoming policy steering committee meeting.

6. Successful Implementation of School Feedings in Nine Study Schools

This activity has been accomplished 100%, not only for the original cohort, but also for the recently enrolled second cohort. 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.

7. Successful Inclusion of Standard I Repeaters in the Research Program

We have been successful in continuing to feed children from the original cohort who have repeated Standard I as well as those who are repeating Standard II. We also have been able to continue to collect full data on these children.

8. Ongoing Measurements

All measurements have been carried out on schedule, quality control procedures have been adhered to and validation and standardization tests run on the methods of measurement used to maintain high quality of the data collected. The staff have been given feedback about the preliminary baseline findings as have the schools and parents, especially about anemia, malaria, stool parasites and health problems needing referral (see above).

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 drier 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 monthly. These observations have been going on since September 1999. The local chiefs and the Rural Health Center staff have been made aware of these households should emergency intervention be required. The District and Provincial Ministers of Health and Education have been very interested in the above information.

What We Were Not Able To Accomplish

Again, our biggest frustration was not being able to leverage more funds than we have to date. Funds are lacking to carry out biochemical micronutrient analyses on the newly enrolled Cohort II, even with the Cattlemen's Grant. Also, it is not possible to carry out a third round of micronutrient analyses on cohort I following three more terms of intervention school feeding.

Because of the limited funding, we are not able to make any commitments for graduate training for our senior staff. There are two excellent doctoral candidates, and one Master's level candidate in Community Nutrition. All of above plan to use project data that they were involved in collecting.

We would like to be able to feed the original Cohort I for an additional one or two terms through July 2000 as the minimum. This will give us a full two years of data. Hopefully we will find funds to feed this cohort for at least one extra term, through November 2000, as the first term of feeding was interrupted by a teacher's strike and data collection was interrupted for four weeks total. Having six full terms of intervention feedings and data collection would strengthen the study. The changes in outcomes that we are seeking take place gradually over time – not quickly, e.g. as in the case of increased physical activity with feeding.

The last activity we did not accomplish during the second year is to hold the meeting of the Policy Steering Committee, as stated above. This has been postponed until to the first part of April

2000. Planning of the agenda, the participant list, venue and arrangements took place in March through June 1999.

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 and the University of Hawaii (S.P. Murphy).

The field coordinator, Dr. Edith Mukudi, a young 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.

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 one 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 secunded to the project for its duration by the Ministry of Health. A Community Field Nutritionist was secunded to us as well to act as a supervisor for the Food Intake enumerators.

Two of the Kenyan nutritionists hope to go on for a Ph.D. and a Masters degree, and the expatriate Field Nutritionist a Ph.D. as well. They plan to use project data for their dissertations. 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 divides 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 and will serve in an advisory role on the steering committee. She will play an important role when we get to a community and household intervention phase. 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 some 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 the research project has nearly a year to run and all data has not been collected, and findings are yet known, even at its early 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 GL CRSP projects 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.

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. (Please see Appendix III for an article in the Nation, Kenya's daily newspaper on this subject).

The health assessment activities of the children 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.

Lastly, 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.

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

- I. Food-based solutions to micronutrient deficiencies; particularly for zinc, iron, vitamins B₁₂ and A, and calcium through the use animal source foods.
- II. The role potential 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 will not receive direct attention until the next phase of the study. As stated in last year's Annual Report, completion of the research when results are known and disseminated. An immediate goal of outreach activities will be to make school feeding both affordable and sustainable by the community itself after the study is completed in the field. There will need to be a 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.

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 two rounds of deworming of Standard I and II children in the 12 study schools and several lectures on household sanitation in the prevention of Giardia and Amoebiasis which are not effected by deworming with Mebendazole.

8. CONTRIBUTIONS TO DEVELOPMENT

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

Iron deficiency and, to a lesser extent, zinc deficiency and vitamin B₁₂ 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 B₁₂ 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 an increase in meat and other animal food consumption.

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 a 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

Socio-economic development of a community and nation will be well served through improving the health, growth and development of its children and enhancing their ability to learn. Should the study results of the controlled intervention study establish a causal relationship between intake of animal foods and the child's cognitive function and growth, this would contribute immeasurably to policy in multiple areas - education, nutrition and health, agriculture, and economics.

C. Linkages and Networking

Interaction has been limited to other East African GLCRSPS projects and the projects in Latin America and the Former Soviet Republics through the common goal of nutrition improvement. The outcome of improvement in human health and nutrition through enhanced livestock production is a shared theme. The BASIS CRSP invited the PI to give a paper at its recent workshop in Addis Ababa, as has ILRI. 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 is promotive of and 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:
 - Through membership in animal credit groups, 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 in action. Also, through 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

C. Concern for Individuals

Children who have severe anemia 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.

10. LEVERAGED FUNDING AND LINKED PROJECTS

A Thrasher Foundation grant for \$32,000 was received for 1998-2000 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”. 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.

As mentioned earlier, we received a grant for \$150,000 for two years from the National Cattlemen’s Beef Association to help enroll a second cohort of children as well as to support ongoing project activities. Travel funding in the amount of \$5,500 was received from the James S. Coleman African Studies Center and International Studies and Overseas Programs (ISOP) at UCLA for travel to East Africa (Kenya, Uganda) in 1998-99.

11. TRAINING IN PROGRESS

<u>Name</u>	<u>Expected Degree</u>	<u>Year</u>	<u>Discipline</u>	<u>Institution</u>
C. Gewa	Ph.D.	2002-3	Nutrition	U. Nairobi or UC Davis *
M.Grillenberger	Ph.D.	2002-3	Nutrition	Wageningen U.
M. Kamore	Ph.D.	2002-3	Psychology	U. Nairobi *
R. Ngaruro	Ph.D.	2002-3	PublicHealth/Nutrition	U. Nairobi or UCLA*
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

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13. COLLABORATING INSTITUTIONS

University of Nairobi	Pediatrics, School of Medicine Applied Nutrition Program College of Agriculture Department of Food Science
Ministry of Health	Nutrition, Planning, Economics
Ministry of Education	Nutrition and Health Division
Makerere University	Child Health and Development Centre
Ministry of Agriculture	Eastern Province, Embu

14. PUBLICATIONS

There have been no project-related publications to date.

15. PRESENTATIONS AND ABSTRACTS

Dr. Charlotte Neumann has made the following presentations on "The Role of Animal Source Foods in Child Growth and Development":

- Heifer Project International Nutrition Symposium, October 14, 1998, Little Rock, Arkansas.
- BASIS CRSP Horn of Africa Regional Workshop, November 1999, Addis Ababa, Ethiopia.

16. COMMENTS

Provincial and district level Ministries of Education, Health and Agriculture are 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 houses 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, has loaned us a vehicle for the remainder of the project. Without this assistance, the project would not have been implemented according to schedule.

APPENDICES

Appendix 1: *Preliminary Descriptive Findings*

Appendix 2: *Photographs*

Appendix 3: *Relevant Newspaper Articles*

Appendix 4: *Data Status Report*